2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter presents detailed descriptions of the alternatives to be evaluated in the impact analysis portion of the Draft Environmental Impact Statement (DEIS) and devotes substantial treatment to each alternative considered in detail so that reviewers can evaluate the comparative elements of each. It identifies the alternatives that were eliminated from further analysis and the reasons they were eliminated. It also describes reclamation, mitigation, and protection options that could be applied to the alternatives considered in detail. Finally, this chapter presents a comparison of the environmental consequences of each alternative in tabular form to sharply define the issues and relative impacts identified, evaluated, and presented in Chapter 3, Affected Environment and Environmental Consequences.

Chapter 2 is organized into eight sections:

- Section 2.1 provides background information on preliminary studies and assessments that were conducted by Emerald Creek Garnet Ltd. (ECG) in order to define a mineable project.
- Section 2.2 introduces the mining techniques that are used and discusses the Proposed Action in two components: 1) the proposed mining plan, and 2) the proposed plans for wetland reclamation, wetland mitigation, and wetland protection.
- Section 2.3 discusses the factors used during alternatives development.
- Section 2.4 describes the alternatives formulation and evaluation process and discusses the criteria used to evaluate alternatives.
- Section 2.5 describes the alternatives that were carried forward for further analysis and provides a rationale for full EIS analysis
- Section 2.6 discusses the alternatives that were considered and eliminated from further analysis.
- Section 2.7 describes wetland reclamation, mitigation, and protection options in response to agency questions during the scoping/pre-application process.
- Section 2.8 presents a comparative summary of environmental impacts by alternative.

2.1 Preliminary Screening of Potential Mining Areas

This section describes the studies undertaken by ECG to identify areas with garnet reserves that could be mined. These studies lead to a determination of the area proposed for mining, an application to the United States Army Corps of Engineers (USACE) for a 404 permit for mining in wetland areas, and the locational focus of alternatives evaluated in this DEIS. The preliminary screening and associated initial studies eliminated some wetlands from consideration for permitting and mining.

Subsequent to federal and State of Idaho permits received in 1994 to mine in the Emerald and Carpenter basins, ECG conducted a preliminary assessment of nearly 1,200 acres of private and public ownership for the presence of alluvial garnet and the practicality of mining that garnet. Locations of potentially mineable garnet were identified in two primary areas: 1) on U.S. Forest Service (USFS) administered lands in the East Fork Emerald and West Fork Emerald Creek drainages; and 2) on private land in the St. Maries River corridor from the vicinity of Clarkia downstream to Santa (refer to Figure 1-2).

2.1.1 Potential Mineable Garnet Area 1

ECG and the USFS have on-going discussions regarding potential future mining in the East Fork and West Fork Emerald Creek drainages. As of 2002, the USFS was in the process of completing a programmatic *Garnet Stars and Sands Environmental Impact Statement* on the feasibility of continued mining in portions of the Emerald Creek basin. ECG's potential activities that are being considered in the Garnet Stars and Sands EIS proposed action include: mining 78 acres of property in the West Fork drainage with small stream alteration and forested wetlands; mining 73 acres of riparian area in the East Fork drainage, adjacent to and including the East Fork channel; mining 84 acres of property in the East Fork drainage with small stream alteration and forested wetland; and mining 59 acres of property with emergent habitat in the East Fork drainage.

The acreage involved in this potential future mining is approximately 294 acres. Wetlands extent within this acreage has not been delineated, but is estimated to comprise about 60 percent of the total acreage. The extent of mineable garnet in the USFS-administered land is not known at this time since reserve studies have not been completed. It is anticipated that any mineable garnet would be coarse material because this area is in an upper watershed position, near the source rock. Mineable garnet would not be the natural 'fine' material found in the proposed mining areas along the St. Maries River, and therefore would not meet one of the statements of need described in Chapter 1, namely to increase the availability of specific reserve grades (natural fine garnet) for target markets.

2.1.2 Potential Mineable Garnet Area 2

In 1995, ECG contracted to have low elevation aerial photographs of the St. Maries River corridor flown and developed. These photographs were used to assess the practicality of mining along the corridor from Cat Spur Creek, above Clarkia, downstream to Fernwood. This area is approximately 880 acres (shown as yellow and blue in Figure 1-2). The area was assessed for wetlands extent by interpreting aerial photos and ground-truthing. Wetlands, including forested, off-channel oxbows, and improved pastures, comprise about 50 percent of this area. The same area was examined for garnet by excavating numerous pits and measuring garnet concentration and depth. Fine mesh garnet was found in most of the area, varying in concentration from 1 to 15 percent, varying in thickness from 2 to 20 feet, and varying in overburden depth from 4 to 30 feet.

An interagency meeting was held in January of 1996 with four State of Idaho agencies and three federal agencies to determine the data needed to develop the necessary reports and documents to permit this area. This meeting included discussions of rare plants and animals, wetland and stream impacts, avoidance techniques, flood issues, and mitigation measures. Discussions regarding the flood issue included concerns about the berm height needed to prevent mining units from flooding,

and the upstream and downstream effects and liabilities associated with the berms potentially altering the natural flood pattern.

ECG determined in April 1997 to evaluate in more detail mining approximately 460 acres of property along the St. Maries River from Emerald Creek to Carpenter Creek. In this area garnet deposits are greatest, and ECG owns property and has established working relationships with several of the other landowners. The April 1997 decision and subsequent investigations resulted in a choice not to pursue mining 420 acres from Cat Spur Creek to Emerald Creek, reducing potential wetlands impacts by approximately 210 acres (50 percent of 420 acres). This decision resulted in avoidance of forested wetlands, oxbow complexes, permanently and semi-permanently inundated wetlands, and grazed and cropped wetland pastures in addition to non-wetland, riparian areas.

Wetland studies were initiated in the 460-acre area in 1997. This area includes the active floodplain of the St. Maries River southwest of Highway 3 and within the historic floodplain areas northeast of Highway 3. A reserve study was initiated in the summer of 1998 in the same area. Between June 1998 and December 1999, alternatives were identified and evaluated by ECG to dredge mine new areas of industrial garnet found in and near the floodplain of the St. Maries River. The reserve investigation confirmed the extent and concentration of garnet deposits in the study areas (Howard 1998). In addition, site-specific environmental studies and inventories, including a wetland delineation (Selkirk Environmental 1999), narrowed the potential permit areas from 460 acres to approximately 327.5 acres of privately held property. The reduction from 460 to 327.5 acres was due to lack of reserves in some areas, avoiding one large oxbow complex, and not mining a parcel of privately held land. Figure 2-1 depicts proposed mining areas A through F along the St. Maries River.

2.2 Overview of Proposed Action

This section briefly describes ECG's plan to mine 327.5 acres of alluvial deposits of industrial garnet. Additional details of the proposed action are found in Volume II, Appendix A of this document, and in the Plan of Operation (ECG 2002).

As noted above, the mine expansion would involve:

- mining of 327.5 acres, including 133.0 acres of wetlands
- in-kind reclamation of all 133.0 acres of wetlands (that is, reclamation to allow wetland functions to be restored)
- providing an additional 29.4 acres of out-of-kind wetlands
- providing long-term protection to all 162.4 acres of post-mining wetlands.

Mining would remain suspended until surface runoff and stream flow return to manageable conditions, and all BMPs are functioning within their capacities. All discharges of storm water runoff would be covered by a National Pollutant Discharge Elimination System (NPDES) permit.

2.2.1 Mining Operations

The proposed mine plan is based on ECG's current and historic annual production goal of 30,000 tons of finished product. This goal is based on the number of mineable days per year, the existing 145-ton-per-day maximum production, and reclamation time requirements. ECG proposes to mine starting at the upstream end and moving downstream in a continuous manner, utilizing both wet mining and dry mining panels. Dredge mining of riparian areas and floodplains encounters numerous environmental variables. This requires different types of mining techniques to accommodate space limitations, seasonal conditions, and proximity to existing streams and rivers. As a result, a combination of wet and dry panel mining is proposed for the mining areas along the St. Maries River.

Wet Panel Mining. Topsoil is stripped from the area being mined, stockpiled, and used to construct a berm separating the area to be mined from the river. Overburden is then stripped off one panel at a time using a trackhoe and bulldozer. A "panel" is a long, narrow area that is mined in one continuous pass. Wet panels generally run perpendicular to the length of the valley, and are typically 300 feet long and 80 feet wide, occupying more than 0.5 acre. All panels are as deep as the garnet layer

The garnet-laden ore is excavated from the open panel and loaded into a wash plant with a dragline or backhoe. The wash plant will have a water containment/recycle system beneath it that will collect water from the wash plant and direct it back into the wet panel. Recycled water, initially pumped from an adjacent body of water, will be used to fill the wet panel after it is opened. Upon completion of one panel, the process will be repeated for each subsequent panel. Overburden from the next panel will be cast into the previous panel before the next panel is mined. The procedure will result in the remaining process waters being transferred to the new panels. This sequence will continue until mining in the area is completed. In this fashion, a wet panel will be open throughout the mining period. All wet panels will be backfilled and rough-graded at the end of the mining year.

Dry Panel Mining. Topsoil is stripped and stockpiled; then the overburden is removed with a trackhoe from an area approximately 40-feet wide by 40-feet long and stockpiled in a corner of the mining unit. Garnet-laden ore is then excavated from the open panel, loaded into dump trucks, and hauled to a wash plant/wet panel. When this panel is completely mined, a second, adjacent panel is opened. The overburden from the second panel is backfilled with returned washed rock into the first panel, compacted, and rough-leveled. This process is repeated sequentially throughout the mining period. Dry panels are then backfilled and regraded within an average of 30 days after completion of mining.

Although this method is called dry panel mining, the "dry" panels often contain water. During the wet season and in areas where the water table may be close to the surface, dry panels may contain ground water. This makes the visual difference between wet and dry mining imperceptible. The difference between the two techniques lies in their operation, rates of reclamation, and required degree of water management.

Wet and Dry Panel Mining. When both Wet and Dry Panel mining methods are used, wet and dry panels are mined concurrently. In this case, the wet panel has two functions. First, it is a mining panel where garnet is extracted. Second, it is a concentration panel where garnet from a dry panel is puddled to increase the concentration. The number of dry panels per wet panel will vary depending

MINING AREA B
AREA EXTENT = 10.5 ACRES
WETLANDS = 1.0 ACRES
ECG ownership-10.5 acres

ADAMS CREEK

PIERCE CREEK

MINING AREA E
AREA EXTENT = 34.1 ACRES
WETLANDS = 21.0 ACRES

HATTON CREEK

#1

CARPENTER CREEK

ECG ownership-55 acres

Oxbow
Complex 1

MINING AREA F
AREA EXTENT = 137.2 ACRES
WETLANDS = 59.9 ACRES

Oxbow
Complex 2

Oxbow
Complex 3

matchline

LEGEND

STUDY AREAS	ST. MARIES RIVER
SEASONAL STREAMS	STATE HIGHWAY 3
PERMANENT STREAMS	ST. MARIES RAILROAD
WETLANDS	ECG OWNERSHIP
OXBOW COMPLEX	OXBOW COMPLEX BUFFER

SCALE: 1 inch = 660 feet

NOTE: Areas #1, #2, and #3
These areas are on the right floodplain. They will be mined,
- if access on ownership to the west can be acquired, or
- if the meander channel is cut-off by normal channel dynamics, or
- if the river can be bridged cost effectively.

If mined, they will be dry mined with proposed setbacks. The channels will not be mined.
These areas are included in the wetland acreage, the reserve estimates, the total acreage, and the mitigation acreage. They are not shown on the conceptual minng sequence because the access to mine is not certain.

PROPOSED MINING AREAS = 327.5 ACRES
EXTENT OF WETLANDS IN PROPOED MINING AREAS = 133.0 ACRES

matchline

OLSEN CREEK

MINING AREA A
AREA EXTENT = 7.5 ACRES
WETLANDS = 3.5 ACRES

ECG ownership-1.2 acres

Oxbow
Complex 4

ECG ownership-39 acres

MINING AREA D
AREA EXTENT = 52.5 ACRES
WETLANDS = 14.5 ACRES

#2

#3

Oxbow
Complex 5

MINING AREA C
AREA EXTENT = 85.7 ACRES
WETLANDS = 33.1 ACRES

EMERALD CREEK

FIGURE 2-1:
PROPOSED MINING AREAS AND WETLAND ACREAGE
EMERALD CREEK GARNET EIS
EMERALD CREEK GARNET LTD

upon the ore concentration and extent of dry mining required. Typically, 6 to 8 dry panels will be opened for each wet panel. Mining activities within each mining area are completed in increments called mining units. Mining units are discrete locations defining where pre-mining and mining activities are completed. Post-mining (reclamation and mitigation) activities are completed in one unit at the same time pre-mining activities are being started in the next sequential mining unit.

Mining Equipment. Specialized equipment is used during the extraction, preliminary processing, transport, and final processing of the garnet ore. The types of equipment include:

Track-Mounted Excavators are used for road construction, diversion ditch installation, and garnet extraction in both wet and dry panel mining. Other common names for this equipment are trackhoe, hydraulic excavator, and hoe.

Track-Mounted Draglines are used in garnet extraction from wet panel mining sites.

Dozers are used for topsoil stripping, overburden removal, and site regrading after mining. Some of the dozers are equipped with Low Ground Pressure (LGP) pads, which enable them to work in soft areas or on wet ground. Other common names for this equipment are cat and swamp cat.

A Wash Plant is used during the preliminary processing of the garnet ore to separate gravel and rock from sand and garnet less than 1/4 of an inch in diameter. Other common names for this equipment are trommel and concentration plant. Each wash plant processes approximately 8,000 tons of material per year.

Twin Axle Dump Trucks are used to haul materials during all phases of the mining and processing operation. These trucks typically have 10 to 12 cubic yard dump boxes.

A Jig Plant is used for final separation of the garnet from the fine sand. Two jig plants will be used during mining operations, one in Emerald Creek basin, and one in Carpenter Creek basin. The jig plants are existing facilities that have a closed system of recycling water.

2.2.2 Best Management Practices and Other Minimization Mitigation Incorporated into Proposed Action

Three types of mitigation have been incorporated into the proposed action: 1) Mining and Reclamation Best Management Practices (BMP), 2) BMP Implementation and Management, and 3) Pre-flood Shutdown Criteria and Procedures.

2.2.2.1 Mining and Reclamation BMPs

Siltation Berm - These structures will be installed around the annual mining unit to capture and contain all surface runoff within the mining unit. They will not be designed to keep river floodflows from entering the annual mining unit. The berms will be impermeable, preventing water from leaving the mining unit. All berms will remain in place through the first winter after all mining activities and rough grading have been completed. The berms will be removed the second spring as topsoil is being replaced, and prior to seeding.

Stabilization Seed Mix - A seed mix will be used for siltation berm stabilization, interceptor and diversion channel stabilization, and upland revegetation. Other seed mixes will be used for wetland reclamation.

Catch Basins - These temporary structures will be used along temporary roads at the outfall of culverts and/or collection points of roadside ditches.

Silt Fencing and Straw Bales - These structures will be installed to prevent sediment from entering a specific area or body of water. The structure will be constructed to create a physical barrier that allows sediment to deposit, and water to flow through or over the structure. These structures, plus large woody debris (LWD) will also be placed intermittently across the reclaimed floodplain to slow flood flows and trap sediments.

Interceptor Channels - These structures will be constructed upslope of the mining unit to collect overland runoff and convey it around the mining unit. In some locations, a biofiltration system will be installed near the end of the channel for sediment removal.

Diversion Channels - These structures will be constructed upslope of the mining unit to collect overland and tributary flow and convey it around the mining unit. In some locations, an interceptor channel will be merged into a diversion channel to prevent construction of multiple channels along the edge of the mining unit. Also a biofiltration system may be installed near the end of the channel for sediment removal.

Sediment Basins - Sediment basins will be constructed at the downstream end of all interceptor and diversion channels where space allows. The basins will be designed to detain runoff from 25-year, 24-hour storm events for a 0.5 square mile area. The basins will be designed to allow settling of suspended sediments and to allow trapping of organic debris. Water will be discharged onto a minimum 30-foot vegetated biofilter strip of undisturbed, native vegetation on the existing floodplain where further settling of sediments will occur.

Vegetated Biofilter Strip - Vegetated biofilter strips will be used at the outflow of all sediment basins. The vegetated biofilter strips will be located to slow storm waters, trap sediments, and biofilter any surface flow before it enters a stream or river.

2.2.2.2 BMP Implementation and Surface Water Management

BMPs will be implemented for both mining and reclamation activities. Management of surface water runoff within each permit area will be completed by focusing activities within the active mining units. BMPs in previously mined areas will be minimized to allow these areas to re-establish pre-mining surface drainage patterns and groundwater regimes as quickly as possible.

Surface water runoff within each of the proposed mining areas will be managed using the mining unit as the boundary as specified in annual mining plans. For each mining unit, an annual stormwater management plan will be implemented.

A Surface Water Management Team will be established to insure proper BMP construction, to inspect BMP integrity, and to specify BMP maintenance requirements. This team will be composed of the Operations Manager, the Field Foreman, and the Company (ECG) Environmental Specialist.

They will be responsible for correct implementation of BMPs and long-term maintenance and monitoring of BMPs.

2.2.2.3 Pre-flood Shutdown Criteria and Procedures

The mining plan incorporates the following avoidance and minimization mitigation, and mining operation safeguards intended to reduce potential flood-related impacts:

- Mining operations will not occur within the ordinary high water line (OHWL) of the St. Maries River.
- Mining will not occur within 30 feet of OHWL.
- Wet mining panels will not be constructed within 30 to 70 feet of OHWL, depending on the alternative.
- Permanent stream channels crossing the floodplain will not be mined.
- Mining operations will not occur when BMPs proper function is limited by excessive surface runoff.

The proposed mining timeframe is year-round, as long as designed BMPs are functioning properly. Short-term hydrologic conditions and other climatic factors may necessitate a temporary suspension of mining. The determination to temporarily suspend mining will be based on proper functioning of BMPs, and on real-time storm and flood forecasting. Storm and flood forecasting would be used to determine implementation of shutdown protocol.

In order to anticipate the need for implementation of shutdown procedures, specific duties have been assigned to a Mining Management Team. This team consists of the Operations Manager, the Field Supervisor, and the Company (ECG) Environmental Specialist. The Operations Manager is responsible for monitoring real-time storm and flood forecasting and implementing shutdown protocol. Under this plan, shutdown or suspension of mining means no equipment is operating in a flood-prone area, and no equipment is stored in a flood-prone area. Wet panels would remain open.

Mining will remain suspended until surface runoff and stream flow return to manageable conditions, and all BMPs are functioning within their capacities. A NPDES permit will be in place that will address an accidental release of sediment-laden water during an extreme flood event.

2.2.3 Proposed Reclamation, and Committed Mitigation and Wetland Protection

ECG has developed a detailed Reclamation Plan that outlines reclamation timeframes, reclamation sequencing, detailed reclamation design concepts as well as reclamation monitoring and performance standards necessary to successfully complete reclamation of the proposed mining units and permit areas. This reclamation plan is the same for all mining alternatives, although it would require modification for the Oxbow Avoidance Alternatives. The reclamation plan includes reclaiming wetlands at 1:1 in-kind replacement, providing 22 percent additional out-of-kind wetlands through compensatory mitigation, offering other compensatory mitigation enhancements, and

providing long-term protection of the reclaimed wetlands. Details of the reclamation plan are in Volume II, Appendix A, and in the Plan of Operations (ECG 2002).

In essence, reclamation begins with pushing washed rock and overburden back into the old mining panels, followed by recontouring the floodplain immediately after mining. Mining BMPs remain in place throughout the following high flow period with topsoil stockpiled. Following the first high flow season, mining BMPs are removed, topsoil is spread, the mining unit is seeded, and reclamation BMPs are placed across the reclaimed floodplain. Following the second high flow season, all woody vegetation is planted, and new oxbows are constructed and planted. By design, these activities would replace wetland functions as quickly as possible, and would provide compensatory mitigation for temporal losses of wetlands incurred during the mining and reclamation maturation processes. Once all reclamation is completed in a mining unit, the unit is fenced and monitored for success until established performance standards are satisfied.

The major points of the reclamation plan include:

- 133 acres of wetlands on ECG and other private ownership reclaimed in-kind at a 1:1 replacement ratio,
- 29.4 acres of additional wetlands created out-of-kind on ECG property (1.7: ratio on ECG property; 1.22:1 overall), as compensatory mitigation,
- Oxbow complexes created before they are mined, as reduction mitigation,
- 30-foot wide top-of-bank along St. Maries River enhanced with woody vegetation, as compensatory mitigation,
- 230+ percent gain in riparian trees provide a 40 percent increase in forested wetlands as well as nearly 17 acres of wildlife corridors, as compensatory mitigation,
- Special habitat features, including snags, downed logs, and forested pockets incorporated into all reclaimed wetlands in ECG property, as compensatory mitigation,
- Long-term fencing around forested wetlands until planted trees are well established, as wetland protection.

2.3 Alternatives Development

Dredge mining operations in a wetland floodplain require mining and reclamation techniques that are unique to the mining areas. This requires the consideration of alternative methods of mining and reclamation of the associated landscapes. The permit process also requires assessment of potential avoidance of high value wetland habitats. The following factors were considered during the development of the alternatives and used to construct the alternatives:

- Timing and duration of mining activities;
- Type of mining method;

- Assessment of oxbow avoidance by evaluating ecological and economic values of each complex, and evaluating practicality of the remaining project area with oxbow avoidance; and

- Reclamation, mitigation, and wetland protection options.

2.3.1 Timing and Duration of Mining

Twelve-month mining would consist of dredge mining at all times of the year under all weather conditions in one, two, or three annual mining units. Twelve-month mining would be limited only by periodic inclement weather, typically occurring approximately 30 days per year. This downtime would include extremely wet conditions prior to the ground freezing in late fall or early winter, and extremely cold periods when thick ice forms. Twelve-month mining provides the maximum flexibility in the sequence of panels mined, allowing ECG to respond quickly to satisfy market conditions, weather conditions, and landowner requirements.

Alternatives to 12-month mining would avoid mining during periods of high flow. These alternatives are called Other Than High Flow Mining. Mandatory suspension of mining would occur during historic periods of river high flow and expected flood events. These alternatives would also be limited by usual inclement weather periods. Mining flexibility, and response to market conditions and landowner requirements would be less than with 12-month mining.

2.3.2 Mining Methods

Alternatives also could include the different types of mining techniques described above: wet panel, dry panel, and a combination of wet and dry panel mining. Each technique allows operation under unique conditions. Wet panel mining is the most efficient, migrating continuously downstream with minimal roads. Wet panels would operate within 30 feet of the river and perennial streams. Wet and dry panel mining could be employed within most mining units. Typically, six to eight dry panels would be opened for each wet panel. Dry panels would be used within 70 feet of the St. Maries River and perennial tributaries. Wet panels would be placed in open, unconfined areas. Dry panel mining could be used exclusively in the mining units with a wet panel located off-site. This alternative provides the slowest mining with the most road development and use

2.3.3 Oxbow Complex Avoidance

The wetland delineation report (Volume II Appendix B) identified six oxbow complexes within the delineated wetlands. These complexes represent the highest value wetland components in the identified wetland complexes along the St. Maries River. Five of the complexes are found in the proposed mining area. Following an evaluation of how mining would affect the five wetland oxbow complexes in the proposed mining area, it was determined to consider some type of oxbow avoidance as an alternative in the alternative analysis process. This evaluation is presented as Appendix C in Volume II.

Initially, a single alternative that entailed the cumulative avoidance of all five oxbow complexes was considered. However, a single avoidance alternative does not adequately reflect the variations in oxbow complex values, either ecological values or economic values. Therefore, a total of five separate oxbow complex avoidance alternatives were considered, which would allow the permit

process to review the differences among the oxbow complexes, and potentially select an avoidance alternative based on those differences.

Because the many possible combinations of avoiding one or more oxbow complexes creates an unmanageable array of alternatives to describe and analyze, three representative oxbow complex avoidance alternatives were identified for evaluation in this DEIS. Safety setbacks or buffers around the oxbows would be needed if the oxbows are not mined. The setbacks would vary from 50 feet to approximately 250 feet, depending upon mining safety issues regarding work in confined areas and near large trees that cannot be removed. In some cases the setbacks would incorporate small, inaccessible areas that would otherwise be accessible if oxbow complexes were mined.

Table 2-1 lists the physical and ecological characteristics used in developing the oxbow avoidance alternatives. Volume II Appendix C provides further details on oxbow complex ecological evaluation and indicators of oxbow complex uniqueness and rarity.

2.3.4 Reclamation Options

A number of general reclamation options were considered during the alternatives development process. Potential reclamation, mitigation, and protection options are summarized in Table 2-2 and discussed in detail in section 2.7.

Table 2-2. Reclamation, Mitigation, and Protection Options

Wetland Reclamation	*Wetland Mitigation*	*Wetland Protection*
• 1:1 Reclamation Replacement Ratio • In-kind Reclamation	• Riverbank Stabilization • In-stream Enhancement • Wetland Banking • Land Acquisition • Out-of-kind Reclamation • BMPs as Minimization Mitigation • >1:1 Reclamation Replacement Ratio • Wetland Avoidance	• Short-term Protection Perimeter Fencing • Long-term Protection Perimeter Fencing • Cluster Fencing • Conservation Easements • Wetland Reserve Programs

2.4 Alternatives Formulation and Evaluation

One of the most important aspects of the environmental impact assessment process is the identification and assessment of reasonable alternatives for avoiding or minimizing the impacts of a proposed action. In addition to mandating consideration of the No Action alternative, National Environmental Policy Act (NEPA) regulations (40 Code of Federal Regulations [CFR] 1502.14) emphasize the selection of a reasonable range of technically feasible alternatives and adequate

Table 2-1. ECG Oxbow Complex Characteristics

	OXBOW CHARACTERISTICS								
	Oxbow Complex Habitats	*Wetland Hydrologic Regimes*	*Oxbow Complex Extent (Acres)*	*Safety Zone (Buffer) Around Oxbow Complex Extent (Acres)*	*Total Extent (Acres)*	*Wetland Extent Within Oxbow Complex & Buffer (Acres)*	*Percent Wetland*	*Indicator(s) of Oxbow Complex Unique/ Sensitive Features*	*Individual Oxbow Complex Comparative Valuation*
Cumulative Complexes 1 through 5	UPL, EM, SS, FO, OW	Seasonal inundated/saturated, Semi-permanently inundated/saturated Permanently inundated	32.8	31.3	64.1	37.0	58%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	n/a
Complex 1	UPL, EM, SS, OW	Seasonal inundated/saturated, Semi-permanently inundated/saturated Permanently inundated	2.8	3.8	6.6	3.6	55%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	3
Complex 2	UPL, EM, SS, OW	Seasonal inundated/saturated, Semi-permanently inundated/saturated Permanently inundated	9.4	11.2	20.6	14.9	72%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	1
Complex 3	UPL, EM, SS, FO, OW	Seasonal inundated/saturated, Semi-permanently inundated/saturated Permanently inundated	9.5	7.9	17.4	8.9	51%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	2
Complex 4	UPL, EM, SS	Seasonal inundated/saturated Semi-permanently inundated/saturated	6.8	4.7	11.5	6.2	54%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	4
Complex 5	UPL, EM, SS	Seasonal inundated/saturated Semi-permanently inundated/saturated	4.3	3.7	8.0	3.4	43%	Not NH site, not NH candidate, not inter-tidal system, not complex forested wetland, not rare peat system, not RTE plant/animal habitat	5

UPL = upland; EM = emergent; SS = scrub-shrub; FO = forested; OW = open water; RTE = rare, threatened, endangered; NH = Natural Heritage

assessment of these alternatives to allow for a comparative analysis for consideration by decision-makers.

For this DEIS, alternatives were formulated to meet the purpose and need for the project, to reduce potential impact to waters of the United States (U.S.), including wetlands, and to consider the implications of no mining under federal permit (No Action). Mining can occur only where garnet is deposited; so alternatives did not include mining elsewhere. Instead, as noted above, mining alternatives are focused on the timing of mining activities, the duration of mining activities, and the type of mining method, and the specific oxbow complexes avoided.

Numerous alternatives were considered. These alternatives were screened to eliminate the alternatives that do not conform to NEPA requirements and/or that are not feasible, reasonable or practical; leaving only those alternatives that might reasonably be considered to be feasible, reasonable, and practical. Five action alternatives and the No Action alternative were carried forward for detailed analysis. Four alternatives were considered and eliminated from further analysis. Table 2-3 summarizes both sets of alternatives. The alternatives are analyzed in detail in sections 2.5 and 2.6.

Table 2-3. Alternatives Summary

Alternatives Considered and Carried Forward[1]	
Alternative 1	No Action (no federal permit issued - no wetland mining)
Alternative 2	12-month Wet Panel Mining, 133 acres of Wetland Mined
Alternative 3	12-month Wet and Dry Panel Mining, 133 acres of Wetland Mined
Alternative 8	Oxbow Avoidance, 84.3 acres of Wetland Mined
Alternative 9	Oxbow Avoidance, 96.9 acres of Wetland Mined
Alternative 10	Oxbow Avoidance, 108.9 acres of Wetland Mined
Alternatives Considered and Eliminated	
Alternative 4	12-month Dry Panel Mining, 133 acres of Wetland Mined
Alternative 5	Other Than High Flow Wet Panel Mining, 133 acres of Wetland Mined
Alternative 6	Other Than High Flow Wet and Dry Panel Mining, 133 acres of Wetland Mined
Alternative 7	Other Than High Flow Dry Panel Mining, 133 acres of Wetland Mined

Note: 1. Wetland reclamation, mitigation, and protection options would be applied to all action alternatives carried forward.

Alternatives Evaluation Criteria

Evaluation criteria were established to assess how closely an alternative satisfies the technical, logistic, economic, and consistency with purpose and need criteria that were established for alternatives comparison. Where possible, absolute thresholds for each factor were established, but in some cases a range of relative thresholds of acceptance is used.

Technical Criterion

The alternatives analysis established four factors to evaluate the technical practicality of alternatives: rate of extraction, equipment requirement, labor requirement, and days of mining per year. These factors were developed on the assumption that the operation would maintain its 30,000 ton per year production goal utilizing existing equipment and labor, without additional capitalization costs.

Rate of Extraction. This factor provides a baseline to evaluate the practicality of each alternative's projected rate of extraction. Extraction rates are derived by dividing the annual production goal of 30,000 tons by the number of mineable days per year. Since ECG currently has the capability of mining up to 145 tons per day with the average reserves proven in the proposed mining area, that is the threshold for this criterion. Alternatives with a rate of extraction less than 145 tons per day are practical; alternatives with a rate of extraction exceeding 145 tons per day are not practical.

Equipment Requirement. This factor provides a baseline to evaluate the practicality of each alternative's projected equipment requirement. ECG has 35 pieces of daily operable equipment and 12 pieces of reserve equipment. The reserve equipment must remain in reserve status as back-up for short-term emergency situations. Therefore, 35 pieces of equipment is the threshold for this criterion. Alternatives with a routine daily equipment requirement of less than 35 pieces were considered to be practical, whereas alternatives with a routine daily equipment requirement exceeding 35 pieces were considered not to be practical.

Labor Requirement. This factor provides a baseline to evaluate the practicality of each alternative's projected labor requirement. ECG currently utilizes 17 permanent field employees to realize the annual production goal. These are experienced skilled laborers, proficient in the use of specific pieces of equipment used by ECG. The regional labor pool does not readily supply qualified laborers for employee replacement or company expansion. ECG's rural location also limits the labor pool availability, as many potential employees have been unwilling to move to an area that requires frequent travel for typical shopping activities, education, and entertainment. Consequently, the existing work force of 17 field laborers is optimum because it is readily supported by the regional labor pool.

From a historical hiring perspective, and within the context of the current and long-term regional labor pool, it is not believed that ECG could successfully expand its field labor force by more than three employees. The available labor is not present in the regional labor pool and ECG cannot rely on less skilled seasonal employees due to reliability, efficiency, and safety reasons. Subsequently, a field labor force of 20 permanent employees is the threshold for this factor. Alternatives with a permanent labor force of 20 or fewer field laborers were considered to be practical, whereas alternatives with a permanent labor force of more than 20 field laborers, or a seasonal labor force of any size were considered not to be practical.

Mining Days. This factor provides a baseline to evaluate the practicality of each alternative's projected number of mining days. The number of mining days per year directly affects the daily production rate. Given an annual production goal of 30,000 tons, and a daily production threshold of 145 tons (based on equipment capacity), the threshold for the number of mining days per year is 208. Therefore, alternatives that provide more than 208 days of mining per year were considered to be practical, whereas alternatives that provide less than 208 days of mining per year were considered not to be practical.

Logistical Criterion

The alternatives analysis established four factors to evaluate the logistical practicality of alternatives. The factors are: hauling trip requirements, Highway 3 access, annual mining efficiency, and response to market. These factors were developed on the assumption that ECG would maintain its 30,000 ton per year production goal utilizing existing equipment and labor, without additional capitalization costs.

Hauling Trips. This factor provides a baseline to evaluate the practicality of each mining alternative's projected hauling trip requirements. Hauling trips include the movement of garnet sand and gravels from a dry panel to a trommel, movement of washed rock from trommel to dry panel, movement of concentrated garnet sand from trommel to jig plant, and movement of garnet from jig plant to mill. This evaluation factor does not have an absolute threshold. The hauling trip requirements were ranked # 1 through #6, with #1 having the least hauling trip requirement. Alternatives with higher hauling trip rankings are less practical than those alternatives with lower hauling trip rankings.

Highway 3 Access. This factor provides a baseline to evaluate both the practicality of oxbow avoidance, and the projected increase in mining traffic on Highway 3. Oxbow avoidance would require one additional improved access point to Highway 3 and through railroad right-of-way to reach all mineable areas. The railroad has denied any new accesses, but will allow present, unimproved accesses to be upgraded. The number of additional trips per day would depend upon the concentration of garnet being mined. This evaluation factor does not have an absolute threshold. Fewer additional accesses and less Highway 3 traffic would result in more efficient mining. Alternatives with additional access are less practical than alternatives with no or less access. The Highway 3 access factor also further reduces available reserves for each oxbow avoidance alternative. This is discussed with each Oxbow Avoidance Alternative.

Annual Mining Efficiency. This factor provides a baseline to evaluate the practicality of the projected impact on annual mining efficiency of oxbow avoidance . Avoidance of oxbow complexes prevents efficient mining of the proposed mining areas in a normal, continuous upstream to downstream manner. Such avoidance places "islands" in the midst of mining areas that disrupt continuous mining and require an additional network of temporary and haul roads to avoid these areas. This evaluation factor does not have an absolute threshold. Less avoidance and fewer temporary and haul roads result in greater annual mining and reclamation efficiency. Alternatives with less or no avoidance are more practical than alternatives with more avoidance.

Response To Market. This factor provides a baseline to evaluate the practicality of each alternative's projected response to market. ECG is acutely aware of sudden changes in market demand and must be able to respond quickly to such changes to remain in a competitive position. Quick response may mean identifying a new annual mining area with specific size and grade of garnet, initiating mining in that area, recovering and processing the garnet, and shipping a final product within a timeline of four weeks or less. The threshold for market response time is four weeks. Alternatives that provide a market response in four weeks or less are practical; alternatives that provide a market response in more than four weeks are not practical.

Economic Criterion

One economic factor was developed to assess the economic practicality of alternatives.

Cost/Valuation (CV) Index Evaluation. A CV analysis was conducted by comparing the costs that would be incurred to mine in the proposed mining area against the return generated from mining the same area. A CV ratio was derived and expressed as a CV Index. Alternatives with a CV index of less than or equal to 0.85 are considered economically practical because the return generated exceeds the cost of mining, including the cost of borrowing money. A CV index greater than 0.85 however, is considered impractical.

Purpose and Need Criterion

Four evaluation factors were identified to assess each of the four needs in the Purpose and Need Statement. The evaluation consideration is the amount of reserves that are mined. The threshold amount of reserves needed is not absolute, but is a range. More mined reserves satisfy the need best. In this case, mining all 193,930 tons best meets this need; mining less than 193,930 tons constrains this need.

Available Reserves. This factor provides a baseline to evaluate the acquisition of additional reserves. ECG has approximately four to seven years of mining remaining in existing permit areas at an annual production rate of 30,000 tons. Permitting of an additional 193,930 tons of reserves would allow ECG to continue operation for nine to 15 years.

Market Longevity. This factor provides a baseline to evaluate ECG's need to insure its customers a long-term supply of garnet. ECG's customer base is similar to many other industries: the end users would like a long-term guarantee of garnet availability. With the current projected mining life of four to seven years under existing permits, ECG will not be able to compete for new customers who require a long-term supply of garnet. With the additional 193,930 tons of garnet in the proposed mining areas, a nine to 15 year mining life is possible, providing ECG a better opportunity to compete for new customers with long-term product needs.

Grade Requirement. This factor provides a baseline to evaluate ECG's ability to provide garnet to specific target markets. ECG has targeted two markets, the oil industry and the water jet cutting industry. The oil industry requires coarse garnet, principally the #8, #8/12, and # 16 mesh sizes. The water jet cutting industry requires fine garnet, ranging from #60 to #150 mesh size. Typically, fine garnet (#80 minus) has been provided by crushing coarse garnet, primarily because "natural fine" garnet has not been available in any mining areas. With growth and high demand for garnet from the oil and water jet cutting industries, the natural fine garnet found in the proposed mining area is needed in order to provide the most competent product to the water jet cutting industry without limiting the supply of coarse garnet for the oil industry.

Mining Efficiency. This factor provides a baseline to evaluate ECG's ability to improve its mining efficiency. Acquisition of the reserves in the proposed mining area increases ECG's mining efficiency in several ways, including ability to operate at capacity, decreased garnet waste from crushing, use of natural fine garnet, and improved reclamation timelines.

Table 2-4. Mining Alternatives Considered and Carried Forward

Evaluation Criteria	*Alternative 1: No Action*	*Alternative 2: 12-month Wet Panel, 133 acres wetland mined*	*Alternative 3: 12-month Wet/Dry Panel, 133 acres wetland mined*
Technical Practicality			
Rate of Extraction avg. tons/day	136 for wet/dry mining; 158 for dry mining	136	136
Equipment requirements (avg. # pieces/month)	31.4 for wet/dry mining areas, and 40.1 for dry mining areas until full time production stops in 2 to 4 years. Then equipment requirements would decrease and equipment inventory would be sold.	washer - 4.0 dragline - 4.0 cat - 5.2 backhoe - 4.7 truck - 9.5 loader - 2.0 TOTAL - 29.4	washer 4.0 dragline - 4.0 cat - 6.2 backhoe - 4.7 truck - 10.5 loader 2.0 TOTAL - 31.4
Labor requirement (avg. # employees/month)	17.3 for wet/dry mining areas, and 22.1 for dry mining areas until full time production stops in 2 to 4 years. Then labor requirements would decrease and shift to a less skilled, seasonal force.	strippers - 2.5 reclaimers - 6.5 washer men - 4.0 truck drivers - 4.0 TOTAL - 17.0	strippers - 3.3 reclaimers - 5.0 washer men - 4.0 truck drivers - 5.0 TOTAL - 17.3
Days of Mining (gross #/year)	220 for wet/dry mining areas; 190 for dry mining areas	220 based on 250 - 30 inclement mining weather	220 based on 250 - 30 inclement mining weather
Practical (Y/N & Why)	NO - production would decrease in next 2 to 4 years. ECG would be unable to provide employment in next 5 to 9 years.	YES - existing equipment inventory adequate. Skilled, permanent work force available. Production rate achievable in mining year.	YES - existing equipment inventory adequate. Skilled, permanent work force available. Production rate achievable in mining year.
Logistic Practicality			
Hauling trip requirements[1]	Baseline condition - not ranked	#1	#4
Response to Market	Inflexible Alternative. ECG will have no expansion into natural "fine' market. Crushing coarse materials for that market would constrain coarse market.	Flexible Alternative. All mesh sizes available 12 months. Able to respond to market demand in 2-4 weeks.	Flexible Alternative. All mesh sizes available 12 months. Able to respond to market demand in 2-4 weeks.
Practical (Y/N & Why)	NO - ECG unable to respond to market.	YES - ECG able to respond to market. Consistent with purpose and need.	YES - ECG able to respond to market. Consistent with purpose and need.
Economic Practicality			
Field Labor (avg. $/acre)	48,422.00	32,055.00	35,273.00
Field Equipment Fuel (avg. $/acre)	24,168.00	22,790.00	22,578.00
Jig Plant/Mill/Staff Operations Labor (avg. $/acre)	31,494.00	31,494.00	31,494.00
Electric/Propane Utilities (avg. $/acre)	5,088.00	5,088.00	5,088.00
Existing Equipment Depreciation (avg. $/acre)	7,909.00	1,879.00	1,879.00
New Equipment Depreciation (avg. $/acre)	3,213.00	763.00	763.00
Reclamation Cost (avg. $/acre)	2040.00	3,922.00	3,922.00
Corporate Office Overhead (avg. $/acre)	52,653.00	12,508.00	12,508.00
Development Costs (avg. $.acre)	8,355.00	1,985.00	1,985.00
Total Costs (avg./acre)	183,342.00	112,484.00	115,490.00
Gross Revenue (avg. annual/acre)	122,578.00	137,400.00	137,400.00
Cost/Value Analysis (CV Index)	CV = 1.50	CV = 0.82	CV = 0.84
Practical (Y/N & Why)	NO – CV Index of 1.50 indicates costs incurred during mining exceeds values derived from mining.	YES - CV Index of 0.82 indicates value derived from mining exceeds costs incurred during mining.	YES - CV Index of 0.84 indicates value derived from mining exceeds costs incurred during mining.
Revenue Lost From No Action (Gross Dollars)	35,480,000.00	0.00	0.00
Consistency with Purpose and Need			
Total Reserves Lost To Oxbow Avoidance (Tons)	n/a	None - oxbows are not avoided	None - oxbows are not avoided
Product Size Lost To Oxbow Avoidance (Mesh Size)	n/a	None - oxbows are not avoided	None - oxbows are not avoided
Effect On Market Longevity	decreases proposed market longevity up to 12 years	Optimizes market longevity	Optimizes market longevity
Effect On Mining Efficiency	Causes inefficiencies in mining	Optimizes market longevity	Optimizes market longevity
Consistency With Purpose And Need	Not consistent with purpose and need	Purpose and need is optimized	Purpose and need is optimized
Practical (Y/N &Why)	NO- does not provide additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.	YES- provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.	YES- provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.
Reasonable/Feasible (Y/N)	NO	YES	YES
Determining factor(s)	Not consistent with purpose and need.	Consistent with purpose and need. Economically practical.	Consistent with purpose and need. Economically practical.
Regulatory/Environmental Considerations			
Proposed New Reserves To Be Mined (tons)	0.0	193,930	193,930
Proposed New Area To Be Mined (acres)	0.0	327.5	327.5
Permitted Reserves To Be Mined (tons)	41,000	0.0	0.0
Permitted Area To Be Mined (acres)	77.8	0.0	0.0
Un-permitted Jurisdictional Wetland Impact	0.0	133.0	133.0
Oxbow Setbacks	None - oxbows would not be mined	none - all oxbows would be mined	none - all oxbows would be mined
Water Appropriations	Existing water appropriation permits apply.	Water appropriation permit required for wet panel and irrigation.	Water appropriation permit required for wet panel and irrigation.

Note: 1. Hauling requirements have been ranked on a relative scale of least to greatest and range from rank #1 to rank #6 (Alternative 1: No Action is not ranked). A ranking of #1 indicates that the least number of haul trips are required whereas a rank of #8 indicates the greatest number of haul trips.

2.5 Mining Alternatives Carried Forward for Analysis

Five action alternatives were considered and carried forward for analysis along with the No Action alternative. Each of the action alternatives described in this section is reasonable and feasible. They are technically, logistically, and economically practical, and are consistent with the purpose and need of the project. Table 2-4 summarizes the discussion of alternatives considered and carried forward.

2.5.1 Alternative 1: No Action

In accordance with NEPA, the No Action alternative presents projections of current conditions to the most reasonable future conditions without the action alternatives being implemented. For purposes of this analysis, the No Action alternative has been determined to consist of 1) no Department of Army Permit issued; and 2) no mining of 133.0 acres of jurisdictional wetlands. Mining of 77.8 acres of non-wetland within the project area under existing state permits would continue.

2.5.1.1 Description

In 2001 and 2002, the State of Idaho issued Dredge Mining Permits (DMPs) 317, 318, 320, and 322 to mine 77.8 acres of non-wetland areas along the St. Maries River and pastures northeast of Highway 3. These areas are part of the 327.5-acre mining area proposed for this permit. Mining was started in these areas in 2001. Approximately 63.8 acres remain to be mined as part of the No Action alternative. There are approximately 41,000 tons of reserves remaining in these four DMPs. These areas are mined using the dry mining technique. At the conclusion of mining, non-wetland areas in DMPs 317, 318, 320, and 322 would have been mined and reclaimed as upland areas. Figure 2-2 shows areas remaining to be mined under the No Action alternative and at other ECG mining areas in the region. Under the No Action alternative, the existing operation would incur decreasing annual production in the next one to two years. The lower rates of production would last until reserves were depleted and mining ceases, in approximately four to seven years. Once annual production began declining, the need for equipment would likewise decrease. Labor requirements would change over time.

2.5.1.2 Evaluation Criteria

Technical, logistic, economic, and consistency with purpose and need criteria are used below to describe aspects of this alternative. These criteria are not used as measures of practicality because the No Action alternative is the baseline activity, i.e., it is what ECG is currently doing and will continue to do if this alternative is selected.

Technical. The 77.8 acres to be mined under the No Action alternative would have an average rate of extraction of 158 tons. This alternative uses an average of 40.1 pieces of equipment and requires an average of 22.1 field workers. Mining would be conducted for approximately 190 days of the year. The technical criteria would continue at their stated values for one to two years when full time production would cease. At that time, equipment requirements would decrease, equipment would be sold, manpower requirements would decrease, the labor force would shift to a less skilled, seasonal force, and the number of mining days per year would decrease.

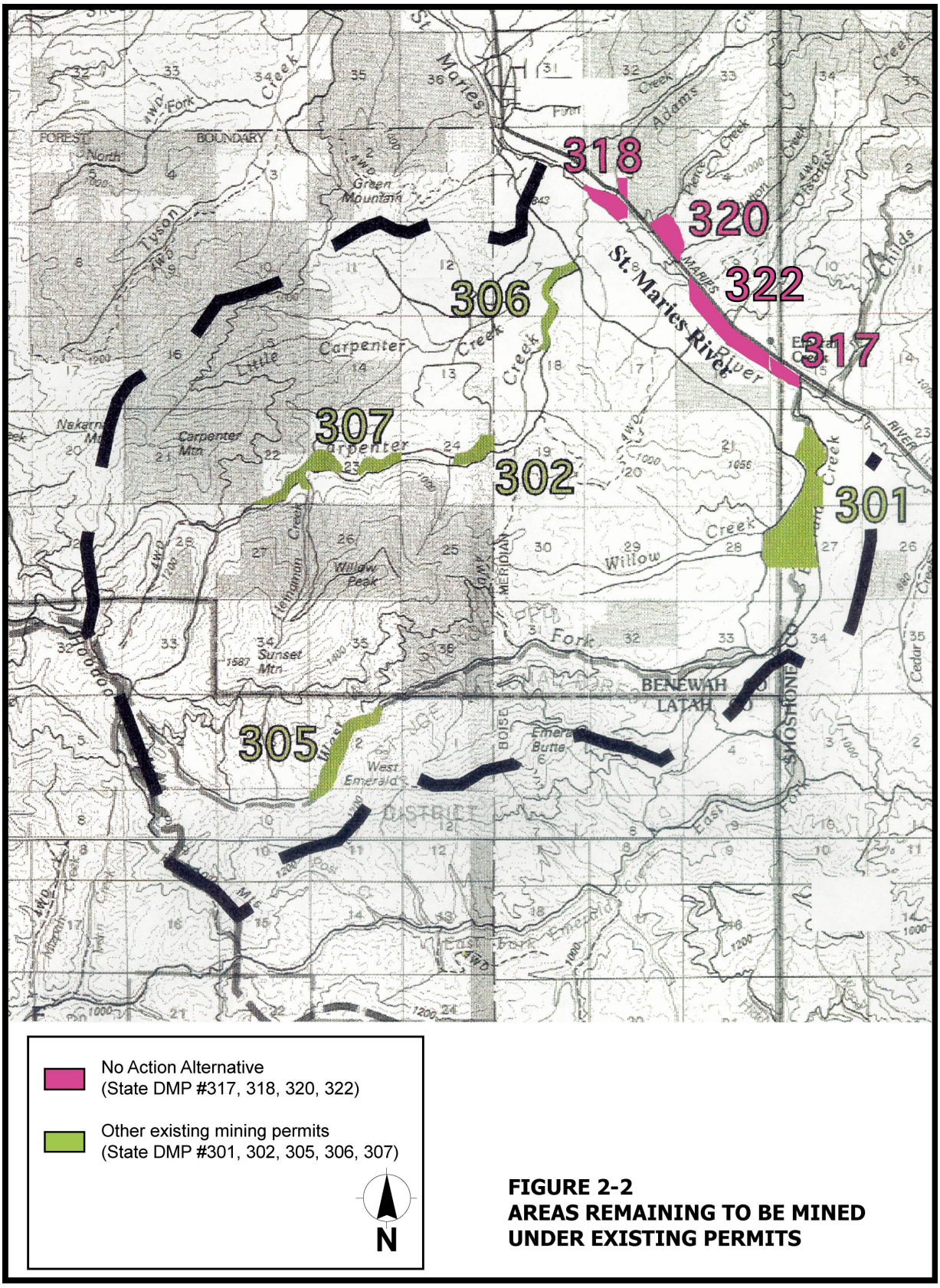


FIGURE 2-2
AREAS REMAINING TO BE MINED
UNDER EXISTING PERMITS

Logistical. The No Action alternative is not ranked for hauling trip requirements because it is the baseline condition. Hauling requirements consist of hauling garnet from the washer to the jig plant, and then to the mill.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. The No Action alternative has a CV index of 1.50. This alternative is not economically practical.

Consistency with Purpose and Need Criteria. This alternative would avoid impact to 133 acres of jurisdictional wetlands. ECG would not have access to all 193,930 tons of reserves. This alternative reduces market longevity to seven years; it results in inefficiencies in mining; and it does not enable ECG to expand its market share in the target markets.

2.5.2 Alternative 2: Twelve Month Wet Panel Mining, 133 Acres of Wetland Mined

Alternative 2 would permit ECG to mine 12 months of the year using wet panel mining techniques in all 327.5 acres of the areas proposed for mining, including 133.0 acres of jurisdictional wetland.

2.5.2.1 Description

This mining method is presently being used in permit areas in Emerald and Carpenter Creek basins. This alternative includes dredge mining at all times of the year under all weather conditions in one, two, or three annual mining units. The entire area proposed for mining would be mined using wet mining panels. Wet panels would be used only to within 30 feet of the St. Maries River and all perennial tributaries. Dry mining panels would be used only in very limited access areas at the operator's discretion. Twelve-month mining would be limited only by periodic inclement weather and equipment downtime due to marginal weather.

2.5.2.2 Evaluation Criteria

Technical, logistic, economic, and consistency with purpose and need criteria are used to evaluate the practicality of this alternative.

Technical. Alternative 2 would have an average rate of extraction of 136 tons per day. It would use an average of 29.4 pieces of equipment in the mining and reclamation process, and require an average of 17 field workers per month without a shift to a temporary, less skilled work force. Under this alternative, mining would be conducted for approximately 220 days of the year, based on an average work year of 250 paid workdays minus approximately 30 days of unscheduled downtime when the weather is too inclement to mine (extremely wet conditions prior to the ground freezing in late fall or early winter, and extremely cold periods when thick ice forms on wet panels).

Alternative 2 is technically practical because the rate of extraction is less than 145 tons per day, the equipment requirement is less than 35 pieces of equipment per day, the labor requirement is a permanent workforce of less than 20 field workers per day, and the number of mining days per year is greater than 208 days. Continued operation would be practical under this alternative.

Logistical. Alternative 2 requires the fewest haul trips, compared to the other alternatives (refer to Table 2-4). Hauling requirements consist of hauling garnet from the washer to the jig plant, and then to the mill. Logistically, this alternative is considered flexible since it enables response to market demand in a two- to four-week period year-round. All product sizes would be available to meet target market demand 12 months of the year. Alternative 2 is logistically practical. The hauling requirement is the most efficient possible and the operator would be able to respond to short-term changes in the market in less than four weeks.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. Alternative 2 has a CV index of 0.82 and thus is economically practical.

Consistency with Purpose and Need. Under Alternative 2, ECG would mine the entire project area, including 133 acres of wetland. Alternative 2 is consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available for mining.

2.5.3 Alternative 3: Twelve Month Wet and Dry Panel Mining, 133 Acres of Wetland Mined

Under Alternative 3, mining would be permitted for 12 months of the year using wet and dry panel mining techniques in all 327.5 acres of the areas proposed for mining, including 133.0 acres of jurisdictional wetland.

2.5.3.1 Description

Similar to Alternative 2, this alternative involves dredge mining at all times of the year under all weather conditions in one, two, or three annual mining units. However, under Alternative 3, the entire area proposed for mining would be mined using a combination of wet and dry mining panels. Dry mining panels would be used within 70 feet of the St. Maries River and all perennial tributaries, adjacent to a 30-foot mining setback. Wet panels would be used in all other areas. Twelve month mining would be limited only by periodic inclement weather, as in Alternative 2. (As noted above, ECG has typically lost approximately 30 days of mining per year due to inclement weather and/or equipment downtime due to marginal weather. This downtime typically includes extremely wet conditions prior to the ground freezing in late fall or early winter, and extremely cold periods when thick ice forms on wet panels.)

2.5.3.2 Evaluation Criteria

Technical. Alternative 3 has an average rate of extraction of 136 tons per day. This alternative uses an average of 31.4 pieces of equipment in the mining and reclamation process, and requires an average of 17.3 field workers per month without a shift to a temporary, less skilled work force. Under this alternative, mining would be conducted for approximately 220 days of the year. This number of production days is based on an average work year of 250 paid workdays minus approximately 30 days of unscheduled downtime when the weather is too inclement to mine.

Alternative 3 is technically practical because the rate of extraction is less than 145 tons per day, the equipment requirement is less than 35 pieces of equipment per day, the labor requirement is a

permanent workforce of less than 20 field workers per day, and the number of mining days per year is greater than 208 days. Continued operation is practical under this alternative.

Logistical. Alternative 3 is ranked fourth in terms of hauling requirements. Hauling requirements consist of hauling garnet ore from dry panels to a washer located in the mining unit, and hauling garnet from the washer to the jig plant, and then to the mill. Logistically, this alternative is considered flexible since it enables response to market demand. All product sizes would be available to meet target market demand 12 months of the year. ECG would be able to respond to changes in market demand in a two to four-week period at any time of year. Alternative 3 is logistically practical. The hauling requirement is the fourth most efficient possible. ECG is able to respond to short-term changes in the market in less than four weeks.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. Alternative 3 has a CV index of 0.84 and is economically practical.

Consistency with Purpose and Need.. Alternative 2 is consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available for mining.

Alternative 3 is consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available for mining.

2.5.4 Oxbow Avoidance Alternatives

Oxbow avoidance alternatives involve no mining of oxbow locations, as discussed in Volume II Appendix C. Three oxbow avoidance alternatives (Alternatives 8, 9, and 10) were evaluated using the preferred mining method, 12-month wet and dry mining, as the baseline mining technique. This mining technique is used as the baseline because mining impacts and wetland impacts are the same regardless of the mining methodology, allowing for comparison of all oxbow avoidance alternatives. Table 2-5 summarizes the discussion of oxbow alternatives considered and carried forward. Logistical, economic, and consistency with purpose and need criteria are used to evaluate the practicality of these three alternatives. Technical criteria are not used because they do not influence the selection of oxbow avoidance alternatives. Figure 2-3 depicts the effects of oxbow avoidance on the accessibility of mineable acreage.

2.5.4.1 Alternative 8: Oxbow Avoidance, 84.3 Acres of Wetland Mined

Description

Alternative 8 would permit mining of 84.3 acres of wetland and would prohibit mining of oxbow complexes 1, 2, 3, 4, and 5. All other proposed mining areas would be mined.

Evaluation Criteria

Logistical. Alternative 8 would require two improved temporary road access points across railroad right-of-way to Highway 3 in order to develop the necessary road network . Additionally, 99.3 acres of mineable ground would not be available for mining, approximately 30 percent of the proposed

mining area. The loss of this acreage creates a patchwork mining approach rather than an efficient, continuous upstream to downstream approach. This necessitates additional roads within the mining areas and more frequent shutdown periods to move mining equipment around oxbow complexes. These additional activities add to the cost of operations making this alternative not logistically practical. Areas made inaccessible under this Alternative are shown in Figure 2-3. The alternative was not dismissed, however, since it would avoid the most valuable wetland areas.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. With Alternative 8, the remainder of the proposed mining area has a CV index of 0.94. Additionally, the oxbow complexes, if mined as discrete units, have a CV index of 0.79. Thus, this alternative is not economically practical.

Consistency with Purpose and Need. Alternative 8 would reduce the total available reserves by 38,002 tons in the oxbows, and 27,574 tons in adjacent, inaccessible areas. The total reserves lost is 65,576 tons, approximately 33.8 percent of the available reserves in the proposed mining area. Lost reserves include both coarse and natural fine grades that are needed for target markets. This alternative would constrain ECG's longevity in the market place, would constrain garnet products for target markets, and would limit ECG's ability to improve mining efficiency. As noted above, however, the alternative was carried forward because it because it would enable the avoidance of impacts to the most valuable wetland areas

2.5.4.2 Alternative 9: Oxbow Avoidance, 96.9 Acres of Wetland Mined

Description

Alternative 9 would permit mining 96.9 acres of wetland, and would prohibit mining of oxbow complexes 1, 2, and 3. All other proposed mining areas would be mined under either Alternative 2 or Alternative 3. As noted in section 2.3.3, these three oxbows have been determined to be the most valuable oxbows from an ecological perspective.

Evaluation Criteria

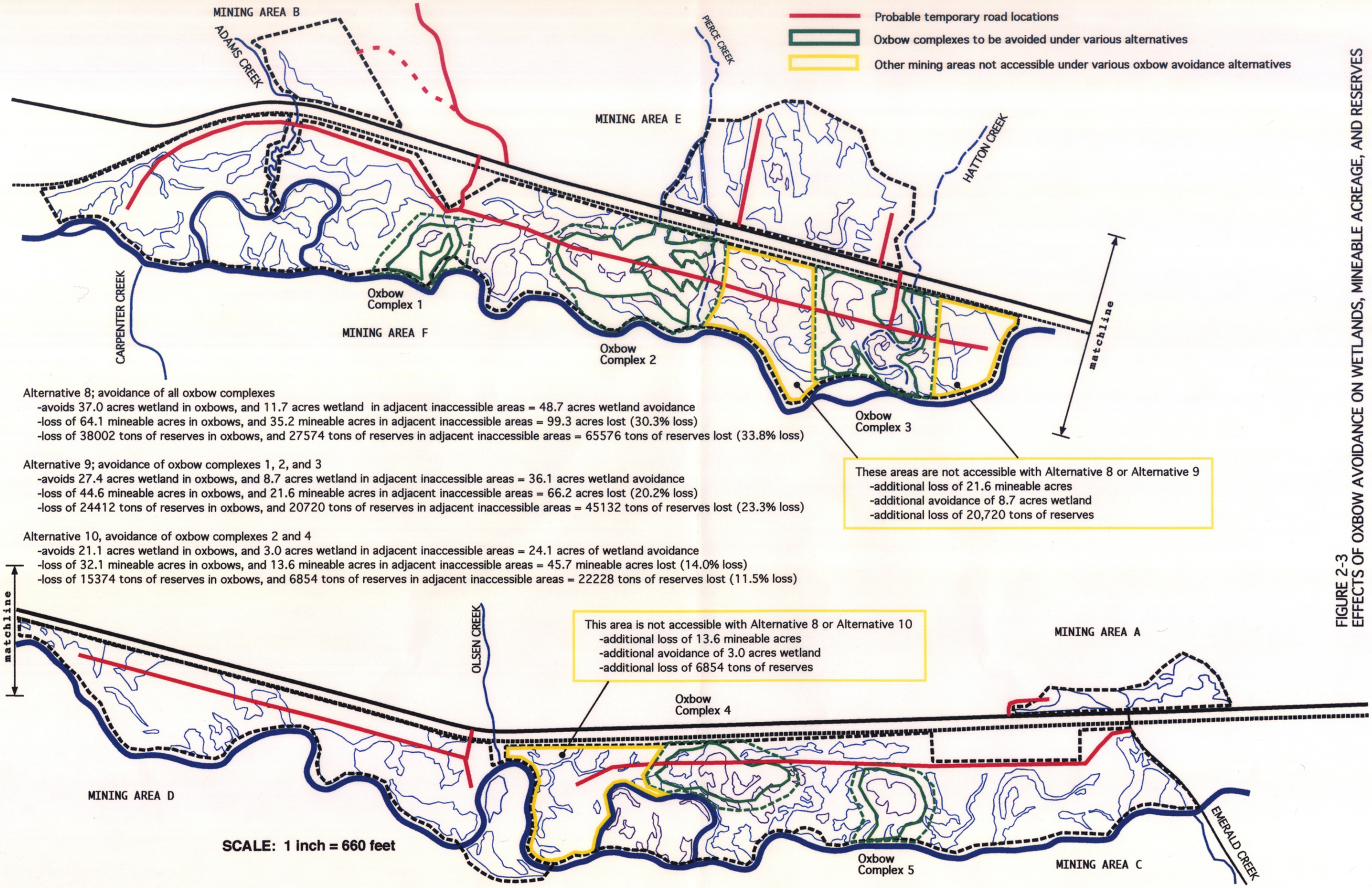
Logistical. Alternative 9 would require two improved temporary road access points across railroad right-of-way to Highway 3 in order to develop the necessary road network. Additionally, 66.2 acres of mineable ground would not be available to ECG: approximately 20 percent of the proposed mining area. The loss of this acreage creates a patchwork mining approach rather than an efficient, continuous upstream to downstream approach. This necessitates additional roads within the mining areas and more frequent shutdown periods to move mining equipment around oxbow complexes. These additional activities add to the cost of operations making this alternative not logistically practical. Areas made inaccessible under this Alternative are shown in Figure 2-3. As with the previous alternative, this alternative is carried forward because it would avoid the valuable wetland areas.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. With Alternative 9, the remainder of the proposed mining area has a CV index of 0.91. Additionally, the oxbow complexes, if mined as discrete units, have a CV index of 0.86. Therefore, this alternative is not economically practical.

Table 2-5. Oxbow Avoidance Alternatives

Evaluation Criteria	*Alternative 8: 84.3 acres of Wetland Mined*	*Alternative 9: 96.9 acres of Wetland Mined*	*Alternative 10: 108.9 acres of Wetland Mined*
Logistic Practicality			
Highway 3 Access Restrictions/Traffic Load	No additional accesses crossing railroad. 4-fold increase in Highway 3 traffic using existing access points.	No additional accesses crossing railroad. 3-fold increase in Highway 3 traffic using existing access points.	No additional access crossing railroad. 2-fold increase in Highway 3 traffic using existing access points.
Overall Mining Efficiency	Avoidance causes patchwork mining pattern, creates additional internal roads.	Avoidance causes patchwork mining pattern, creates additional internal roads.	Avoidance causes patchwork mining pattern, creates additional internal roads.
Practical (Y/N &Why)	NO – 99.3 minable acres lost due to oxbow avoidance and lack of access to adjacent areas; creates mining inefficiencies	NO - 66.4 minable acres lost due to oxbow avoidance and lack of access to adjacent areas; creates mining inefficiencies	NO – 45.7 minable acres lost due to oxbow avoidance and lack of access to adjacent areas; creates mining inefficiencies
Economic Practicality[1]			
Revenue Lost From Avoidance (Gross Dollars)	15,213,600.00	10,470,600.00	5,156,900.00
CV Index of Project Minus Avoidance Acreage	CV = 0.94	CV = 0.91	CV = 0.83
CV Index Of Oxbow Complex	CV = 0.79	CV = 0.86	CV = 0.99
Practical (Y/N &Why)	NO - avoidance is not practical when the remainder of the project becomes impractical (CV = 0.94), and when mining all oxbows is profitable (cumulative complex CV = 0.79).	NO - avoidance is not practical when the remainder of the project becomes impractical (CV = 0.91), and when mining oxbows is profitable (cumulative complex CV = 0.86).	YES - avoidance is practical when the remainder of the project remains practical (CV = 0.83), even when mining oxbows is not profitable (cumulative complex CV = 0.99).
Overall Economic Practicality of Project with Oxbow Avoidance (Y/N & Why)	NO –the loss of 64.1 acres of oxbow complex and another 35.2 acres of inaccessible property make the remainder of the project (228.2 acres) impractical to mine. CV Index = 0.94.	NO –the loss of 44.6 acres of oxbow complex and another 21.6 acres of inaccessible property make the remainder of the project (261.3 acres) impractical to mine. CV Index = 0.91.	YES –the loss of 32.1 acres of oxbow complex and another 13.6 acres of inaccessible property still allow the remainder of the project (281.8 acres) to be practical to mine. CV Index = 0.83.
Consistency with Purpose and Need			
Total Reserves Lost To Avoidance (Tons)	65,576	45,132	22,228
Product Size Lost To Avoidance (Mesh Size)	coarse and natural fine	coarse and natural fine	natural fine
Effect On Market Longevity	Reduces longevity by 33.8% (61 months)	Reduces longevity by 23.3% (42 months)	Reduces longevity by 11.5% (21 months)
Overall Market Impact From Avoidance	Constrains ability to compete in target markets, reduces market longevity.	Constrains ability to compete in target markets reduces market longevity.	Constrains ability to compete in natural fine market, reduces market longevity.
Consistency With Purpose And Need	Not Consistent - avoidance impacts market longevity and competitiveness in target markets.	Not Consistent - avoidance impacts market longevity and competitiveness in 'fine' market.	Not Consistent - avoidance impacts market longevity and competitiveness in 'fine' market.
Practical (Y/N &Why)	NO- not consistent with purpose and need. Tonnage lost is 33.8% of available, garnet is a water dependent resource, is not readily available in non-wetland areas.	NO- not consistent with purpose and need. Tonnage lost is 23.3% of available, garnet is a water dependent resource, is not readily available in non-wetland areas.	NO- not consistent with purpose and need. Tonnage lost is 11.5% of available, garnet is a water dependent resource, is not readily available in non-wetland areas.
Reasonable/Feasible to Carry Forward (Y/N & Why)	NO -not reasonable to avoid Oxbow Complexes 1 through 5 because the remainder of the project is not economically practical, and purpose and need is severely compromised.	No -not reasonable to avoid Oxbow Complexes 1, 2, and 3 because the remainder of the project is not economically practical, and purpose and need is severely compromised.	NO -not reasonable to avoid Oxbow Complexes 2 and 4 because the remainder of the project is not economically practical and purpose and need is compromised.
Oxbow Avoidance Characteristics			
Oxbow Complexes Avoided	Complexes 1, 2, 3, 4, and 5	Complexes 1, 2, and 3	Complexes 2 and 4
Safety Zone Width (Feet)	50 - 250 ft.	50 - 250 ft	50 - 250 ft
Minable Acreage Lost To Oxbow Avoidance (Acres)[2]	64.1	44.6	32.1
Minable Acreage Lost Due To Access Limitation (Acres)	35.2	21.6	13.6
Total Minable Acreage Lost (Acres)	99.3	66.2	45.7
Regulatory/Environmental Considerations			
Wetlands Avoided By Oxbow Avoidance (Acres)	37.0	27.4	21.1
Wetlands Avoided By Access Limitation (Acres)	11.7	8.7	3.0
Total Wetland Avoidance (Acres)[2]	48.7	36.1	24.1
Total Area Mined (Acres)	327.5-99.3 = 228.2	327.5-66.2 = 261.3	327.5-45..7 = 281.8
Jurisdictional Wetland Impact	133.0-48.7 = 84.3	133.0-36.1 = 96.9	133.0-24.1 = 108.9
Oxbow Setback Width (Feet)	50-250 ft	50-150 ft	50-250 ft
Oxbow Complex Overall Environmental Value	Medium	Medium	Medium
Ability to Mitigate if Oxbow Complex Mined (Y/N & Why)	YES - all wetland functions can be replaced with a reclamation plan that restores topography, hydrology, and vegetation.	YES - all wetland functions can be replaced with a reclamation plan that restores topography, hydrology, and vegetation.	YES - all wetland functions can be replaced with a reclamation plan that restores topography, hydrology, and vegetation.

Note: 1. Economic practicality based on 12-month wet and dry panel mining method.
2. Minable acres and wetland avoidance acres are different because oxbow complexes and adjacent buffers include non-wetland areas. See Figure 2-1 that shows wetland extent, oxbow complexes, and oxbow complex buffer extent.



Alternative 8; avoidance of all oxbow complexes
-avoids 37.0 acres wetland in oxbows, and 11.7 acres wetland in adjacent inaccessible areas = 48.7 acres wetland avoidance
-loss of 64.1 mineable acres in oxbows, and 35.2 mineable acres in adjacent inaccessible areas = 99.3 acres lost (30.3% loss)
-loss of 38002 tons of reserves in oxbows, and 27574 tons of reserves in adjacent inaccessible areas = 65576 tons of reserves lost (33.8% loss)

Alternative 9; avoidance of oxbow complexes 1, 2, and 3
-avoids 27.4 acres wetland in oxbows, and 8.7 acres wetland in adjacent inaccessible areas = 36.1 acres wetland avoidance
-loss of 44.6 mineable acres in oxbows, and 21.6 mineable acres in adjacent inaccessible areas = 66.2 acres lost (20.2% loss)
-loss of 24412 tons of reserves in oxbows, and 20720 tons of reserves in adjacent inaccessible areas = 45132 tons of reserves lost (23.3% loss)

Alternative 10, avoidance of oxbow complexes 2 and 4
-avoids 21.1 acres wetland in oxbows, and 3.0 acres wetland in adjacent inaccessible areas = 24.1 acres of wetland avoidance
-loss of 32.1 mineable acres in oxbows, and 13.6 mineable acres in adjacent inaccessible areas = 45.7 mineable acres lost (14.0% loss)
-loss of 15374 tons of reserves in oxbows, and 6854 tons of reserves in adjacent inaccessible areas = 22228 tons of reserves lost (11.5% loss)

FIGURE 2-3
EFFECTS OF OXBOW AVOIDANCE ON WETLANDS, MINEABLE ACREAGE, AND RESERVES

Consistency with Purpose and Need. Alternative 9 would reduce the total available reserves by 24,412 tons in oxbows, and 20,720 tons in adjacent inaccessible areas. Total reserves lost would be 45,132 tons, approximately 23.3 percent of the available reserves in the proposed mining area. Lost reserves include both coarse and natural fine grades that are needed for ECG's target markets. This alternative would constrain ECG's longevity in the market place, would constrain garnet products for target markets, and would limit ECG's ability to improve mining efficiency.

2.5.4.3 Alternative 10: Oxbow Avoidance, 108.9 Acres of Wetland Mined

Description

Alternative 10 would permit mining of 108.9 acres of wetland, and would prohibit mining of oxbow complexes 2 and 4. All other proposed mining areas would be mined under either Alternative 2 or Alternative 3. As discussed in section 2.3.3, these two oxbows have been determined to be the least valuable, economically.

Evaluation Criteria

Logistical. Alternative 10 would require three improved temporary road access point across railroad right-of-way to Highway 3 in order to develop the necessary road network and avoid oxbow complexes. Additionally, 45.7 acres of mineable ground would not be available to ECG, approximately 14 percent of the proposed mining area. The loss of this acreage creates a patchwork mining approach rather than an efficient, continuous upstream to downstream approach. This necessitates additional roads within the mining areas and more frequent shutdown periods to move mining equipment around oxbow complexes. These additional activities add to the cost of operations making this alternative not logistically practical. Areas made inaccessible under this Alternative are shown in Figure 2-3. As with the previous two alternatives, this alternative is carried forward because it would avoid the valuable wetland areas.

Economic. Economic practicality is based on a CV index, derived by a comparison of costs incurred to mine against the return generated from mining. With oxbow avoidance, the remainder of the proposed mining area has a CV index of 0.83. Additionally, the oxbow complexes, if mined as discrete units, have a CV index of 0.99. This alternative is economically practical.

Consistency with Purpose and Need. Alternative 10 would reduce the reserves by 15,374 tons in the oxbows, and6,854 tons in the adjacent inaccessible areas. Total available reserves would reduce by 22,228 tons, approximately 11.5 percent of the available reserves in the proposed mining area. Lost reserves include natural fine grades that are needed for one of ECG's target markets. This alternative would constrain ECG's longevity in the market place, would constrain garnet products for target markets, and would limit ECG's ability to improve mining efficiency.

2.6 Mining Alternatives Eliminated from Further Analysis

Four mining alternatives were considered and eliminated from further analysis because they were not reasonable or feasible. Although each of the alternatives is consistent with the purpose and need of the project, each is technically, logistically, and economically impractical. Table 2-6 summarizes the discussion of alternatives considered and eliminated.

2.6.1 Alternative 4: Twelve Month Dry Panel Mining, 133 Acres of Wetland Mined

Alternative 4 proposes dredge mining at all times of the year under all weather conditions in one, two, or three annually mined units. The entire area proposed for mining would be mined using dry mining panels. Excavated garnet would be hauled to a wet panel/washer facility located outside the proposed mining areas and outside the St. Maries River floodplain.

Technical. Alternative 4 is technically impractical because the rate of extraction would be more than 145 tons per day, the equipment requirement would be more than 35 pieces of equipment per day, the labor requirement would be a permanent workforce of more than 20 field workers per day, and the number of mining days per year would be less than 208 days. Continued operation is not practical under this alternative.

Logistical. Alternative 4 is logistically impractical. The hauling requirement is one of the least efficient possible. ECG would be unable to respond to short-term changes in the market in less than four weeks.

Economic. Alternative 4 is economically impractical. This alternative has a CV index of 1.07. The rate of return for this alternative would not be sufficient to pay the costs of operation and attract a continual flow of investment.

Consistency with Purpose and Need. Alternative 4 is consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available for mining.

2.6.2 Alternative 5: Other Than High Flow Wet Panel Mining, 133 Acres of Wetland Mined

Alternative 5 would consist of dredge mining at all times of the year in one, two, or three mining units, except during flood-prone periods of the St. Maries River. The entire area proposed for mining would be mined using wet mining panels. Excavated garnet would be processed at an on-site wet panel/washer facility. The flood-prone period has been defined by a hydrograph of the St. Maries River based on thirty years of flow data collected from a downstream stream gage near Santa, Idaho. The hydrograph identified a 25-day period from mid-January to early February when floods in excess of a 10-year event have historically occurred (refer to Volume II Appendix A, Figure A-8). Under Alternative 5, no mining activities would occur in the active floodplain during the 25-day flood-prone period.

Technical. Alternative 5 would be technically impractical because the rate of extraction would be more than 145 tons per day, the equipment requirement would be more than 35 pieces of equipment per day, the labor requirement would be a less skilled seasonal workforce of 17 field workers per day, and the number of mining days per year would be less than 208 days. Continued operation is not practical under this alternative.

Logistical. Alternative 5 would be logistically impractical. Although the hauling requirement is one of the most efficient possible, ECG would be unable to respond to short-term changes in the market in less than four weeks under this alternative.

Table 2-6. Mining Alternatives Considered and Eliminated

Evaluation Criteria	*Alternative 4: 12-month Dry Panel, 133 acres wetland mined*	*Alternative 5: Other Than High Flow Wet Panel, 133 acres wetland mined*	*Alternative 6: Other Than High Flow Wet/Dry Panel, 133 acres wetland mined*	*Alternative 7: Other Than High Flow Dry Panel, 133 acres wetland mined*
Technical Practicality				
Rate of Extraction avg. tons/day	158	154	154	182
Equipment requirements (avg. # pieces/month)	washer - 4.7 dragline - 4.7 cat - 7.4 backhoe - 6.7 truck - 14.6 loader - 2.0 TOTAL - 40.1	washer - 5.0 dragline - 5.0 cat - 6.0 backhoe - 6.0 truck - 12.0 loader 2.0 TOTAL - 36.0	washer 5.0 dragline - 5.0 cat - 7.0 backhoe - 6.0 truck - 13.0 loader - 2.0 TOTAL - 38.0	washer - 6.0 dragline - 6.0 cat - 7.0 backhoe - 7.0 truck - 19.0 loader - 2.0 TOTAL - 47.0
Labor requirement (avg. # employees/month)	strippers - 4.7 reclaimers - 2.7 washer men - 4.7 truck drivers - 10.0 TOTAL - 22.1	strippers - 3.0 reclaimers - 2.0 washer men - 5.0 truck drivers - 7.0 TOTAL - 17.0	strippers - 4.0 reclaimers - 2.0 washer men - 5.0 truck drivers - 8.0 TOTAL - 19.0	strippers - 6.0 reclaimers - 3.0 washer men - 6.0 truck drivers - 13.0 TOTAL - 28.0
Days of Mining (gross #/year)	190 based on 250 - 30 inclement mining weather - 30 no hauling during break-up	195 based on 250 - 25 flood prone days - 30 inclement mining weather	195 based on 250 - 25 flood prone days - 30 inclement mining weather	165 based on 250 - 25 flood prone days- 30 inclement mining weather - 30 no hauling during break-up
Practical (Y/N & Why)	NO - existing equipment inventory inadequate. Labor force will increase and shift to seasonal, less skilled workers. Production rate realized only with more equipment.	NO - existing equipment inventory inadequate. Labor force will increase and shift to seasonal, less skilled workers. Production rate realized only with more equipment.	NO - existing equipment inventory inadequate. Labor force will increase and shift to seasonal, less skilled workers. Production rate realized only with more equipment.	NO - existing equipment inventory inadequate. Labor force will increase and shift to seasonal, less skilled workers. Production rate realized only with more equipment.
Logistic Practicality				
Hauling trip requirements[1]	#5	#2	#4	#6
Response to Market	Alternative is not flexible. Must stockpile to anticipate sales. Not able to respond quickly to market demand during non-mining period.	Alternative is not flexible. Must stockpile to anticipate sales. Not able to respond quickly to market demand during non-mining period.	Alternative is not flexible. Must stockpile to anticipate sales. Not able to respond quickly to market demand during non-mining period.	Alternative is not flexible. Must stockpile to anticipate sales. Not able to respond quickly to market demand during non-mining period.
Practical (Y/N & Why)	NO - 10 new pieces of equipment needed at $2.1-2.7m cost. ECG unable to respond to market quickly.	NO - 6 new pieces of equipment needed at $1.2-1.6m cost. ECG unable to respond to market quickly.	NO - 9 new pieces of equipment needed at $2.1-2.8m cost. ECG unable to respond to market quickly.	NO - 18 new pieces of equipment needed at $3.7-5.3m cost. ECG unable to respond to market quickly.
Economic Practicality				
Field Labor (avg. $/acre)	48,422.00	38,466.00	42,328.00	58,107.00
Field Equipment Fuel (avg. $/acre)	34,132.00	25,440.00	29,680.00	39,114.00
Jig Plant/Mill/Staff Operations Labor (avg. $/acre)	31,494.00	30,240.00	30,240.00	30,240.00
Electric/Propane Utilities (avg. $/acre)	5,088.00	5,088.00	5,088.00	5,088.00
Existing Equipment Depreciation (avg. $/acre)	1,879.00	1,879.00	1,879.00	1,879.00
New Equipment Capitalization (avg. $/acre)	8,244.00	4,885.00	8,550.00	16,183.00
Reclamation Cost (avg. $/acre)	3,922.00	3,922.00	3,922.00	3,922.00
Development Costs (avg. $/acre)	1,985.00	1,985.00	1,985.00	1,985.00
Corporate Office Overhead (avg. $/acre)	12,508.00	12,508.00	12,508.00	12,508.00
Total Costs (avg./acre)	147,674.00	124,413.00	136,180.00	169,026.00
Gross Revenue (avg. annual/acre)	137,400.00	137,400.00	137,400.00	137,400.00
Cost/Value Analysis (CV Index)	CV = 1.07	CV = 0.91	CV = 0.99	CV = 1.23
Practical (Y/N & Why)	NO - CV Index of 1.07 indicates costs incurred during mining exceeds value derived from mining.	NO - CV Index of 0.91 indicates costs incurred during mining exceeds value derived from mining.	NO - CV Index of 0.99 indicates costs incurred during mining exceeds value derived from mining.	NO - CV Index of 1.23 indicates costs incurred during mining exceeds value derived from mining.
Consistency with Purpose and Need				
Total Reserves Lost To Oxbow Avoidance (Tons)	None - oxbows are not avoided	None - oxbows are not avoided	None - oxbows are not avoided	None - oxbows are not avoided
Product Size Lost To Oxbow Avoidance (Mesh Size)	None - oxbows are not avoided	None - oxbows are not avoided	None - oxbows are not avoided	None - oxbows are not avoided
Effect On Market Longevity	Optimizes market longevity	Optimizes market longevity	Optimizes market longevity	Optimizes market longevity
Effect on Mining Efficiency	Optimizes market longevity	Optimizes market longevity	Optimizes market longevity	Optimizes market longevity
Consistency With Purpose And Need	Purpose and need is optimized	Purpose and need is optimized	Purpose and need is optimized	Purpose and need is optimized
Practical (Y/N &Why)	YES - provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.	YES - provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.	YES - provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.	YES - provides additional garnet required to increase market longevity, to meet demands of target markets, or to improve mining efficiency.
Reasonable/Feasible (Y/N)	NO	NO	NO	NO
Determining factor(s)	Not technically, logistically or economically practical.	Not technically, logistically or economically practical.	Not technically, logistically or economically practical.	Not technically, logistically or economically practical.
Regulatory/Environmental Considerations				
Total Reserves Mined (tons)	193,930	193,930	193,930	193,930
Total Area Mined (acres)	327.5	327.5	327.5	327.5
Jurisdictional Wetland Impact	133.0	133.0	133.0	133.0
Oxbow Setbacks	0 - 250 ft., depends on oxbow avoidance option selected, if any	0 - 250 ft., depends on oxbow avoidance option selected, if any	0 - 250 ft., depends on oxbow avoidance option selected, if any	0 - 250 ft., depends on oxbow avoidance option selected, if any
Water Appropriations	Water appropriation permit required for irrigation only.	Water appropriation permit required for wet panel and irrigation.	Water appropriation permit required for wet panel and irrigation.	Water appropriation permit required for irrigation only.

Note: 1. Jig plant and mill hauling requirements have been ranked on a relative scale of least to greatest and range from rank #1 to rank #8 (Alternative 1: No Action is not ranked). A ranking of #1 indicates that the least number of haul trips are required whereas a rank of #8 indicates the greatest number of haul trips.

Economic. Alternative 5 would be economically impractical. This alternative has a CV index of 0.91. The rate of return for this alternative would not be sufficient to pay the costs of operation and attract a continual flow of investment.

Consistency with Purpose and Need. Alternative 5 is consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves are available to ECG.

2.6.3 Alternative 6: Other Than High Flow Wet and Dry Panel Mining, 133 Acres of Wetland Mined

This alternative would consist of dredge mining at all times of the year in one, two, or three mining units, except during flood-prone periods of the St. Maries River. The entire area proposed for mining would be mined using a combination of wet and dry mining panels. Dry mining panels would be used within 70 feet of the St. Maries River and streams that cross the floodplain, and in other locations at ECG's discretion. Wet panels would be used outside the 70-foot setback at ECG's discretion.

Technical. Alternative 6 would be technically impractical because the rate of extraction is more than 145 tons per day, the equipment requirement is more than 35 pieces of equipment per day, the labor requirement is a less skilled, seasonal workforce of 19 field workers per day, and the number of mining days per year is less than 208 days. Continued operation would not be practical under this alternative.

Logistical. Alternative 6 would be logistically impractical. The hauling requirement is one of the least efficient possible. ECG would be unable to respond to short-term changes in the market in less than four weeks.

Economic. Alternative 6 would be economically impractical. This alternative has a CV index of 0.99. The rate of return for this alternative is not sufficient to pay the costs of operation and attract a continual flow of investment.

Consistency with Purpose and Need. Alternative 6 would be consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available to ECG.

2.6.4 Alternative 7: Other Than High Flow Dry Panel Mining, 133 Acres of Wetland Mined

Technical. Alternative 7 would be technically impractical because the rate of extraction is more than 145 tons per day, the equipment requirement is more than 35 pieces of equipment per day, the labor requirement is a less skilled, seasonal workforce of more than 20 field workers per day, and the number of mining days per year is less than 208 days. Continued operation would not be practical under this alternative.

Logistical. Alternative 7 would be logistically impractical. The hauling requirement is the least efficient possible. ECG is unable to respond to short-term changes in the market in less than four weeks.

Economic. Alternative 7 would be economically impractical. This alternative has a CV index of 1.23. The rate of return for this alternative is not sufficient to pay the costs of operation and attract a continual flow of investment.

Consistency with Purpose and Need. Alternative 7 would be consistent with Available Reserves, Market Longevity, Grade Requirement, and Mining Efficiency criteria because all 193,930 tons of reserves would be available to ECG.

2.7 Reclamation Options

This section discusses various reclamation options identified in response to agency questions during the scoping/pre-application process. For purposes of discussion, reclamation options have been segregated into three elements: wetland replacement, wetland mitigation, and wetland protection. These options are all carried forward into Chapter 3 for detailed evaluation. This section describes the options, and outlines their attributes and constraints.

A major discriminator for this comparison is the location where replacement, mitigation, and protection options would occur. Three locations have been identified: on-site property owned by ECG; on-site property owned by other private landowners; and as-yet-undetermined off-site areas. The proposed permit areas are entirely privately owned, 105.7 acres owned by ECG, and the remaining 221.8 acres owned by other individuals/corporations. As a condition of the mining lease agreements with other landowners, the post-mining land use must be the same as the pre-mining land use, so post-mining land use is common to all alternatives and reclamation options.

2.7.1 Wetland Replacement Options

For the purpose of ECG's Plan of Operations (ECG 2002) and for this permit process, replacement is defined as reclaiming the post-mining landscape to its pre-mining condition. This means returning wetlands and uplands back to equivalent hydrologic and habitat conditions, and returning them back to the same size and in the same geographic location as in the pre-mined state.

2.7.1.1 1:1 On-Site In-Kind Replacement

ECG Ownership

This option consists of replacing all wetlands within ECG's ownership on a 1:1 per acre in-kind basis. ECG would mine the 35 acres of wetland on ECG's property, and would replace 35 acres in the same locations as they occurred prior to mining. Following mining and reclamation, the 35 acres would be the same wetland habitats and hydrologic regimes as the pre-mining condition.

Attributes. This option makes temporary potential wetland impacts that would occur from mining. It provides the reclaimed wetlands with the same functions as the pre-mined wetlands. The option is efficient to implement since mining equipment is staged on-site for reclamation activities. In this

manner, reclamation follows mining without a lag time. This option also would be efficient because mining plans can be designed and implemented with reclamation in mind, saving time and costs.

Constraints. This option would involve the temporary loss of wetland functions during the time the wetlands are being mined and while the replaced landscape is maturing to the pre-mining condition.

Other Private Ownership

This option consists of replacing all wetlands on other private ownership lands within the proposed permit areas on a 1:1 per acre basis. ECG would mine the 98 acres of wetland on other property, and would replace 98 acres of wetland in the same locations as they occurred prior to mining. The 98 acres would be composed of equivalent wetland habitats and hydrologic regimes as the pre-mining condition.

Attributes. This option makes temporary the wetland impacts that would occur from mining. It provides the reclaimed wetlands with the same functions as the pre-mined wetlands. It would be efficient to implement since mining equipment is staged on-site for reclamation activities. Reclamation would follow mining without a lag time. This option would be efficient because mining options could be designed and implemented with reclamation in mind, saving time and costs.

Constraints. This option would involve the temporary the loss of wetlands that would occur during the time the wetlands are being mined, and while the replaced landscape is maturing to the pre-mining condition.

2.7.2 Wetland Mitigation Options

For the purpose of ECG's Plan of Operations and for this permit process, wetland mitigation is defined as any reclamation option that consists of more than 1:1 in-kind replacement of wetland acreage and functions. This DEIS assesses six potential wetland mitigation options; three on-site options and three off-site options:

- On-site wetland enhancement: ECG ownership or other private ownership
- On-site riverbank enhancement: ECG ownership or other private ownership
- On-site in-stream enhancement: ECG ownership or other private ownership
- Off-site wetland enhancement, any ownership
- Off-site wetland mitigation banking
- Off-site land acquisition

2.7.2.1 On-Site Wetland Enhancement

ECG Ownership

This option consists of more than 1:1 replacement of wetland acreage and out-of-kind replacement. ECG would increase the overall wetland acreage from the pre-mined state, and would provide more scrub-shrub and forested habitat, and more long-term inundation.

Attributes. This option is typically used by permitting agencies to offset the temporal losses that occur while mining wetlands and occur until the reclaimed wetlands mature. It provides an increase in the value of wetland functions. The value would maximize as the reclaimed wetland matures. The increases in functional value would be achieved by 1) increasing wetland extent 24.5 acres, a 1.7:1 ratio; 2) increasing PFO1E habitat 70 percent; 3) increasing PEM1F habitat 70 percent; 4) increasing PSS1E habitat 70 percent; 5) increasing PSS1F habitat 70 percent; 6) increasing semi-permanently and permanently inundated habitats 70 percent; 7) adding special habitat features including snags, downed logs, and wildlife corridors; and 8) increasing riparian/wetland trees by 230 percent.

This option would be efficient to implement since mining equipment is staged on-site for reclamation activities. Reclamation would follow mining without a lag time. This option is also efficient because mining activities can be designed and implemented with reclamation in mind, saving time and costs. Equipment can efficiently mine for part of a day, and reclaim for part of a day, as needed.

Constraints. This option would not have any constraints on ECG's ownership.

Private Ownership

This option consists of more than 1:1 replacement of wetland acreage and out-of-kind replacement. ECG would increase the overall wetland acreage from the pre-mined state, and would provide more scrub-shrub and forested habitat, and more long-term inundation.

Attributes. This option is typically used by permitting agencies to offset the temporal losses that would occur from mining wetlands. It provides an increase in the value of wetland functions; the value would maximize as the reclaimed wetland matures. The increases in functional value would be achieved in the same manner as ECG's property. It would be efficient to implement since mining equipment is staged on-site for reclamation activities. Reclamation would follow mining without a lag time. This option is also efficient because mining activities can be designed and implemented with reclamation in mind, saving time and costs. Equipment can efficiently mine for part of a day, and reclaim for part of a day.

Constraints. This option is a constraint to other private landowners. These landowners require in lease agreements for mining that their property be returned to the pre-mined state so that they can continue their current land use practices.

2.7.2.2 On-Site Riverbank Enhancement

ECG Ownership

This option consists of planting woody vegetation within a 30-foot wide setback along the St. Maries River. This would increase the acreage of scrub-shrub and forested habitat. These plantings may be in wetlands, or in non-wetland, riparian areas.

Attributes. The increase of scrub-shrub and forested wetlands would increase the overall value of reclaimed wetland/riparian functions and would increase the habitat potential for most non-aquatic riparian invertebrates and vertebrates. The plantings would also provide detritus to the St. Maries River. At maturity, plantings at the top-of-bank would provide a source of woody debris recruitment and shade for the river.

Constraints. This option has no constraints on ECG's property.

Other Private Ownership

This option consists of planting woody vegetation within a 30-foot wide setback along the St. Maries River. This would increase the acreage of scrub-shrub and forested habitat. The plantings may be in wetlands, or in non-wetland, riparian areas.

Attributes. The increase of scrub-shrub and forested wetlands would increase the overall reclaimed wetland value and would increase the habitat potential for most non-aquatic riparian invertebrates and vertebrates. The plantings would also provide detritus to the St. Maries River. At maturity, plantings at the top-of-bank would provide a source of woody debris recruitment and shade for the river.

Constraints. This option would be a constraint to other private landowners. In lease agreements, the landowners require that their property be returned to the pre-mined state so that they can continue their current land use options.

2.7.2.3 On-Site In-Stream Enhancement, ECG or Other Private Ownership

This option would use structures and stabilization techniques within the bankful width of the St. Maries River to enhance the bank sideslopes and stream channel character. This would be accomplished by using in-stream drop structures, LWD anchored into the bank, and vertical bank excavation and revegetation.

Attributes. This option has the objective of stabilizing unvegetated, vertically cut banks that are eroding and adding sediment to the river system. It would also improve fish habitat by providing deeper pools and woody cover.

Constraints. The St. Maries River is an incised system with continuous bar development in many reaches. It is unable to access its floodplain in many areas adjacent to this proposed project. The river lacks adequate shade and has high bedload from current and historical activities within the drainage basin. As a result, the river has high water temperatures, at times creating a thermal barrier

to fish. In general, the St. Maries River has numerous issues that cannot be redressed by a single project that abuts only about 3.3 miles of its shoreline. These conditions create a minimal effectiveness for this type of project-specific enhancement.

2.7.2.4 Off-Site Enhancement, Any Ownership

Off-site enhancement is assumed to occur in the same drainage basin and/or nearby tributaries as the proposed mining activity. Land availability in this area has not been determined. The proposed on-site mitigation creates an additional 29.5 acres of wetland. Regulatory agencies usually seek a 2:1 ratio when exchanging enhancement for creation. Therefore, the conceptual off-site enhancement area would need to have at least 60 acres of degraded wetland to be equivalent to proposed on-site enhancements. The area to be enhanced, acquired, and/or banked would need to have the following attributes:

- Approximately 30 acres of higher value wetland to be acquired and/or protected
- Approximately 60 acres of degraded wetland to be enhanced
- Within a 30-mile roundtrip distance from the proposed permit area
- Similar enhancement as on-site, i.e., seasonal to permanent inundation with PEM1, PSS1, and PFO1 habitats
- Excavated material to be hauled off-site

This option would improve the condition of any wetland area in the drainage basin, along the St. Maries River or along nearby streams and increase the value of wetland functions. This option could be used in place of, or potentially in conjunction with, on-site enhancement options.

Attributes. This option would increase the value of the enhanced wetland functions, varying with the type of enhancement undertaken. It has the potential of correcting wetland degradations from past land use activities.

Constraints. ECG is proposing on-site rather than off-site enhancement. This off-site option would involve a timeline to find the appropriate off-site location and could delay permit authorization. It would also require ECG's control of the property (i.e., short-term ownership or lease until it is passed into third party hands).

2.7.2.5 Off-Site Mitigation Banking

This option would require ECG to place money in a fund that provides wetland mitigation at identified sites where mitigation is banked until needed for a project. This would provide off-site mitigation over and above the on-site replacement. Banking generally is accomplished by acquiring a degraded wetland in the same watershed and selling enhancement credits that allow a portion of the wetland to be enhanced, or repay for a portion that has already been enhanced.

Attributes. This would be attractive if a banking program were already established. ECG could make a payment to the bank and not be involved in the cost and time of site selection, environmental studies, enhancement designs, or long-term monitoring.

Constraints. A bank has not been established in this area. ECG would need to be involved in site selection, environmental studies, enhancement designs, and possibly in land acquisition. The extended period this would require would be a major constraint if it delayed permit authorization.

2.7.2.6 Off-Site Land Acquisition

This option would require ECG to purchase land outside the project area to protect an existing wetland, to provide wetland enhancement, and/or to construct additional wetlands.

Attributes. This option would increase the value of the enhanced wetlands functions, varying with the type of enhancement undertaken. It has the potential of correcting wetland degradations from past land use options.

Constraints. A site may not be readily available within the drainage basin that would meet the selection criteria.

2.7.3 Wetland Protection Options

Numerous wetland protection mechanisms were discussed during the scoping and initial permit process. Short-term protection options protect re-established wetlands until reclamation performance standards have been realized. Long-term protection options protect woody vegetation from grazing for an extended period, and permanently protect the re-established wetlands. Four on-site options have been identified:

- Short-term On-site Perimeter Fencing, ECG Ownership or Other Private Ownership
- Long-term On-site Perimeter Fencing, ECG Ownership or Other Private Ownership
- Long-term On-site Cluster Fencing, ECG Ownership or Other Private Ownership
- Long-term On-site Conservation Easement, ECG Ownership or Other Private Ownership

Two off-site wetland protection options have been identified:

- Long-term Off-site Perimeter Fencing
- Long-term Off-site Conservation Easement

2.7.3.1 Short-Term On-Site Perimeter Fencing

ECG Ownership

This option would provide short-term wetland protection until reclamation performance standards are satisfied. All reclaimed wetland areas would be protected with barbed wire fencing for a 5-year monitoring period, or longer if performance standards have not been satisfied.

Attributes. Fencing would exclude cattle from the reclaimed areas for a 5-year period, or until performance standards are satisfied.

Constraints. This option has no constraints on ECG's property.

Other Private Ownership

This option would provide short-term wetland protection until reclamation performance standards are satisfied. All reclaimed wetland areas would be protected with barbed wire fencing for a 5-year monitoring period, or longer if performance standards have not been satisfied.

Attributes. Fencing would exclude cattle from the reclaimed areas for a 5-year period, or until performance standards are satisfied.

Constraints. This option has no constraints on other private property, although other landowners typically would want this fencing to be removed as soon as possible. Some landowners would require ECG to provide alternate pasture until this fencing is removed.

2.7.3.2 Long-Term On-Site Perimeter Fencing

ECG Ownership

This option would provide long-term wetland protection well after performance standards are satisfied. It is proposed in response to agency concerns that cattle grazing has an adverse impact on the riparian ecosystem being reclaimed. ECG would fence all reclaimed areas they own as long as ECG owns the property, or until a change in land use occurs.

Attributes. This option would exclude cattle from ECG's reclaimed lands and eliminate potential impacts associated with cattle grazing as long as ECG owns the property, or until a change in land use occurs.

Constraints. This option would eliminate the historical grazing of ECG's property as a future use. It would eliminate grazing fees as a source of income for ECG. It also would place additional grazing pressure on adjacent properties under open range laws.

Other Private Ownership

This option would provide long-term wetland protection well after performance standards are satisfied. It is proposed to address agency concerns that cattle grazing has an adverse impact on the riparian ecosystem being reclaimed. ECG would fence all reclaimed areas on other private ownership properties.

Attributes. This option would exclude cattle from other private ownership properties and would eliminate potential impacts associated with cattle grazing.

Constraints. This option would eliminate grazing from a large portion of other landowners' properties and would place additional grazing pressure on properties that remain available under open range laws. This option is a severe constraint to other landowners and is not permitted under the terms of mining lease agreements.

2.7.3.3 Long-Term On-Site Cluster Fencing

ECG Ownership

This option would place fencing around clumps of trees and shrubs until they meet specified heights and/or diameters. The intent is to realize a tree and shrub stature that cattle cannot impact.

Attributes. This option would provide long-term protection to planted and transplanted trees and shrubs.

Constraints. This option would require the removal of short-term perimeter fencing and installation of many small clusters of fencing. It is labor intensive and more expensive than perimeter fencing.

Other Private Ownership

This option would place fencing around clumps of trees and shrubs until they meet specified heights and/or diameters. The intent would be to realize a tree/shrub stature that cattle cannot impact.

Attributes. This option would provide long-term protection to planted and transplanted trees and shrubs and would allow grazing to commence as soon as possible after performance standards have been satisfied.

Constraints. This option would require the removal of short-term perimeter fencing and installation of many small clusters of fencing. It is labor intensive and more expensive than perimeter fencing.

2.7.3.4 Long-Term On-Site Conservation Easement

ECG Ownership

A conservation easement is a restriction placed on a piece of property to protect the resources (natural or human-made) associated with the parcel. The easement is either voluntarily sold or donated by the landowner and constitutes a legally binding agreement that prohibits certain types of development (residential or commercial) from taking place on the land. Easements have been used to provide governments, utilities, and extractive industries with certain property rights. An easement permits the holder certain rights regarding use of the land for specified purposes, while the ownership of the land remains with the private property owner. It is designed to exclude certain activities on private land such as commercial development or residential subdivisions. The easement is typically described in terms of the resource it is designed to protect (e.g., agricultural, forest, historic, or open space easements).

An easement is a legally binding covenant that is publicly recorded and runs with the property deed for a specified time or in perpetuity. It gives the holder the responsibility to monitor and enforce the property restrictions imposed by the easement for as long as it is designed to run. An easement does not grant ownership nor does it absolve the property owner from traditional owner responsibilities (i.e., property tax, maintenance, or improvements). The owner of the property is the only one who can decide to place a conservation easement on his or her property. If the property is

mortgaged, the mortgage holder must also be in agreement for the easement to be placed. A conservation easement is a voluntary land-protection tool that is privately initiated.

A conservation easement is designed to protect a property according to the owner's wishes. Since the easement is generally granted in perpetuity, it is necessary for an outside party to be responsible for the monitoring and maintenance of the easement. The outside party "holds" the easement and is required to monitor and enforce the adherence of current and future property owners to the terms of the easement.

This long-term option would use deeded easements and third party administration to protect reclaimed wetlands. ECG would create a conservation easement on the reclaimed property that would provide land use restrictions. One application of this is the Wetland Reserve Program (WRP) where the federal government, under administration of the Natural Resources Conservation Service (NRCS), compensates landowners who place their properties into conservation easements.

Attributes. This option would permanently protect the reclaimed wetlands from cattle grazing.

Constraints. This option would place severe restrictions on the marketability of the reclaimed property. The property could not be sold to a ranch as viable rangeland. It could not be subdivided and viably sold as mini-farms, ranchettes, or waterfront home sites, all of which are possible future land uses in this area.

Other Private Ownership

This long-term option would use deeded easements and third party administration to protect reclaimed wetlands. ECG would create a conservation easement on the reclaimed property that would provide land use restrictions. One application of this is the WRP where the federal government, under administration of the NRCS, compensates landowners who place their properties into conservation easements.

Attributes. This option would permanently protect the reclaimed wetlands from cattle grazing.

Constraints. This option would place severe restrictions on current use and on the marketability of the reclaimed property. Other private landowners would see this as an unacceptable constraint to the use of their property. Mining lease agreements do not allow this type of impact to future land use.

2.7.3.5 Long-Term Off-Site Perimeter Fencing

This option would have the same general description and attributes as the on-site version described in section 2.7.3.2. It would be implicit in off-site mitigation options and would be implemented to protect the off-site activity areas from cattle grazing. It would become an integral part of off-site mitigation designs and management.

2.7.3.6 Long-Term Off-Site Conservation Easement

This option has the same general description and attributes as the on-site versions described in section 2.7.3.4. This option would be implicit in off-site mitigation options and would be

implemented to protect the off-site property from cattle grazing. It would become an integral part of off-site mitigation designs and management.

2.8 Comparative Summary of Environmental Impacts by Alternative

Table 2-7 provides a comparison of the potential environmental impacts of the No Action and action alternatives. The environmental impact analysis is discussed in detail in Chapter 3, *Affected Environment and Environmental Consequences*.

Table 2-7. Comparison of Environmental Impacts, No Action and Action Alternatives (Page 1 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Water Resources							
Water Withdrawal and Releases • Additional water withdrawal for wet panel mining from St. Maries River. • Overtopping of site BMPs for storms in excess of 25-year storm/flood event.	No impacts expected.	Insignificant impact. Site flow contribution is 5 to 8 percent of total site runoff. Annual water withdrawal would range from 588,000 to 1,764,000 cubic feet (.20 cubic feet per second [cfs]-spring and .40 cfs - summer). Reduced instream flow equals 0.4 and 0.6 percent respectively. Withdrawal would be an insignificant impact to hydrologic regime of St. Maries River.	—	—	—	—	—
Sedimentation and Erosion • Sedimentation to be controlled by sedimentation basins and other BMPs for 25-year flows. Construction of temporary and haul roads; project site BMPs, and mine operations may generate sediment.	No impacts expected.	Impact low because probability of 25-year or greater flood occurrence event is 4 percent or less in any give year.	—	—	—	—	—
Floodplain Alterations • Sedimentation berms around mining panels may prevent all flows up to and including the 5-year event from reaching the floodplain. This can alter localized hydrologic regime.	None (floodplain alteration would not occur. Mining would be limited to upland areas.).	Impacts would be localized to the floodplain area adjacent to a berm and duration would be brief.	—	—	—	—	—

Table 2-7. Comparison of Environmental Impacts of No Action and Action Alternatives (Page 2 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Impacts Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Wetlands							
Direct Impact to Wetland Area (327.5 acres mined) • Land clearing and excavation in wetland habitats. • Temporary stockpiling of topsoil in wetlands • Temporary placement of fill in wetlands for roads, equipment pods, and siltation berms. • Dredged material sidecast into wetland areas in the construction of diversion channels and sediment basins.	33.3 acres mined under existing permit.	—	133 acres	133 acres	96 acres	105.6 acres	111.9 acres
Direct Impact to Wetland Types	—	—	Impacts to forested wetland, scrub shrub wetland habitat, and emergent wetlands	Impacts to forested wetlands, scrub shrub wetland habitat, and emergent wetlands.	Impacts to forested wetlands, scrub shrub wetland habitat, and emergent wetlands	Impacts to forested wetlands, and scrub shrub wetlands habitat.	Impacts to forested wetlands, and scrub shrub wetland habitat.
Acres of Direct Wetland Impact to Oxbows and Associated Buffers	—	—	Impact to all 5 oxbow complexes - 32.8 acres	Impact to all 5 oxbow complexes - 32.8 acres	Oxbows not mined.	Oxbow complexes 1, 2, and 3 not mined.	Oxbow complexes 2 and 4 not mined.
Percentages of Acres of Direct Impact Relative to Total Wetland Acreage (133 acres)	—	—	133 acres - 100 percent	133 acres - 100 percent	84.3 acres – 63.4 percent	96.9 acres – 73 percent	108.9 acres - 82 percent
Potential Indirect Wetland Impacts • Alteration of wetland hydrology from changes in drainage patterns, changes in runoff volumes, and/or changes to local alluvial groundwater flow gradients. • Increased delivery of non-point source pollution to adjacent wetland areas, e.g., temporary increases in sediment loads from land clearing activities, seasonal pulses of sediment from winter road maintenance, and petroleum distillates, metals, and rubber contained in stormwater from ordinary machinery wear.	—	The potential for indirect impacts is the same for all alternatives.	—	—	—	—	—

Table 2-7. Comparison of Environmental Impacts of No Action and Action Alternatives (Page 3 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Wildlife Habitat							
Direct removal of vegetation due to mining activities • Alteration of plant community structure through mature tree and shrub removal. • Result in early successional stages favoring weeds. • Increased invasion risk of non-native plants, including noxious weeds.	77.8 acres of vegetation removed	Temporary vegetation removal would occur under all alternatives.	194 acres of other vegetation directly impacted (327 acres to be mined minus 133 acres of wetlands).	Same as Alternative 2.	Least amount of non-wetland vegetation acreage impacted among all action alternatives. 167 acres of other vegetation directly impacted (327 acres to be mined minus 96 acres of wetlands and minus 64 acres of oxbows avoided).	177.4 acres of other vegetation directly impacted (327 acres to be mined minus 105.6 acres of wetlands and minus 44 acres of oxbows avoided).	184 acres of other vegetation directly impacted (327 acres to be mined minus 111 acres of wetlands and minus 32 acres of oxbows avoided).
• Incremental loss of woody shrub habitat.	—	A total of 693 trees would be lost over the mining period.	—	—	—	—	—
• Effects to rare, threatened, and endangered plants.	—	—	May affect, not likely to adversely affect water howellia.	Same as Alternative 2	May affect, not likely to adversely affect Water Howellia. Likelihood of impact on Water Howellia is less than Alternatives 9 and 10 because all oxbows are avoided.	May affect, not likely to adversely affect Water Howellia. Because this alternative avoids the highest value oxbows, the likelihood of impact on Water Howellia is less than Alternative 10.	Likelihood of potential impact on Water Howellia is greater than Alternatives 8 and 9.
Potential indirect impact due to increased invasion of exotic plants in disturbed areas.	Potential indirect impact within existing mining areas.	The potential for occurrence of this indirect impact is the same for all alternatives.	—	—	—	—	—
Wildlife							
Direct impact due to temporary loss of habitat.	77.8 acres of habitat would be temporarily impacted.	Mortality of small and immobile wildlife species. Temporary loss of bird nesting, foraging, roosting, and wintering habitat. Temporary loss of breeding, foraging, and wintering habitat. Increase in disturbance would increase area of impact.	Greater acreage of temporary habitat loss.	Greater acreage of temporary habitat loss.	Least acreage of temporary habitat loss.	Acreage of temporary habitat loss greater than Alternative 8 but less than Alternatives 2, 3, and 10.	Acreage of temporary habitat loss greater than Alternatives 8 and 9, but less than Alternatives 2 and 3.
Potential indirect impacts include: • Temporary avoidance of habitat due to noise activities associated with mining. • Disruption of wildlife movement • Displacement of habitat.	Potential indirect impacts within existing mining are the same for all alternatives.	Potential indirect impacts are the same for all alternatives. Increase in disturbance would increase area of impact.	—	—	—	—	—

Table 2-7. Comparison of Environmental Impacts of No Action and Action Alternatives (Page 4 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Fisheries							
Direct impacts due to mining of oxbows and tributaries. • Loss of oxbow habitat for several fish species. Damage to eggs or disturbance to spawning fish could occur. • Loss of oxbows as travel corridors to reach important habitat. • Effects to threatened, endangered, and other special status species. • Temperature change due to reduced canopy.	No impacts expected.	—	Alternatives 2 and 3 would be similar in terms of potential impact.	Same as Alternative 2.	Least potential for impact to fisheries and macro invertebrate habitat due to avoidance of 5 oxbows comprising 64 acres.	Greater potential impact to fisheries and macro invertebrates than Alternative 8 but less than Alternatives 2 and 3 due to avoidance of 3 high-value oxbow complexes comprising 44 acres.	Greater potential impact to fisheries and macro invertebrates than Alternative 8 and 9 but less than Alternatives 2 and 3 due to avoidance of 2 lower-value oxbow complexes comprising 32 acres.
Potential temporary indirect impacts due to degradation of fish habitat by mining of wetlands.	No impacts expected.	Temporary impact would depend on acreage of wetlands affected. No permanent impacts anticipated.	—	—	—	—	—
Earth Resources							
Impacts to soil/earth resource • Excavation for wet and dry panel mining will temporarily displace soil.	Excavated material to be used as part of BMPs or contained within mining units. No permanent impacts.	Excavated material to be used as part of BMPs or contained within mining units. No permanent impacts.	—	—	—	—	—
• Soil erosion and compaction.	The potential for impact would be the same for all alternatives.	The potential for impact would be the same for all alternatives. Road building and mining activity could cause temporary erosion and compaction. Reclamation would reverse impacts.	—	—	—	—	—
• Soil sloughing.	Soil sloughing risk would be low as slope in the area ranges from 0 to 4 and ratings for shrink swell and erosion are low.	Very low soil sloughing risk (slope in the area ranges from 0 to 4, ratings for shrink swell and erosion are low).	—	—	—	—	
Land Use and Ownership							
Changes in land use/ownership.	No impacts expected.	No impacts expected. Mining is an established land use in the region. The proposed use is consistent with all applicable plans and ordinances. Land ownership would not change. Leases would be established between private owners in the project area.	—	—	—	—	—

Table 2-7. Comparison of Environmental Impacts of No Action and Action Alternatives (Page 5 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Traffic, Transportation, and Access							
Direct impacts resulting from the addition of new temporary roads and haul roads and the addition of truck and employee traffic to the existing and proposed roadway system: • Physical degradation of existing roads used by mining trucks. • Traffic service levels. • Safety conditions.	No impacts expected.	6-10 haul trips per day. Traffic service and safety impacts expected to be low due to low traffic volumes.	No new temporary roads or haul roads.	No new temporary roads or haul roads.	Three additional roads required.	Two additional roads required.	Two additional roads required.
Cultural Resources							
Impacts to archaeological, architectural or traditional resources. Consultation with interested Native American groups is underway.	No impacts expected.	No impacts expected. Possibility for inadvertent discovery of deeply buried cultural resources.	Increased possibility of inadvertent discovery of deeply buried cultural resource due to a greater number of acres being mined. Probability is low.	Increased possibility of inadvertent discovery of deeply buried cultural resource due to a greater number of acres being mined. Probability is low.	—	—	—
Socioeconomics							
Direct employment loss and indirect/ induced employment loss within three to five years.	Potential job loss impacts.	Extend period of mining (10 to 20 years) without job loss. Net benefit to regional economy due to extended operation.	12-year extended period of mining, i.e., no job loss.	12-year extended period of mining, i.e., no job loss.	Reduces extended mining period in Alternatives 2 and 3 by 39 months.	Reduces extended mining period in Alternatives 2 and 3 by 25 months.	Reduces extended mining period in Alternatives 2 and 3 by 16 months.
Potential indirect impacts due to population loss: • Vacancy rate • Reduced retail sales • Public finance from taxes	Low impact potential.	Impact likely to be low as population directly and indirectly associated with mining is low.	—	—	—	—	—
Visual Resources							
Natural landscape changed to a culturally modified landscape.	No significant change since mining activity is near existing mining activity.	No significant change since mining activity is adjacent to existing mining activity.	—	—	—	—	—

Table 2-7. Comparison of Environmental Impacts of No Action and Action Alternatives (Page 6 of 6)

Environmental Impact or Issue	*Alternative 1: No Action*	*Common to All Action Alternatives*	Unique to Alternative				
			Alternative 2	*Alternative 3*	*Alternative 8*	*Alternative 9*	*Alternative 10*
Noise/Air Quality							
Increased noise activities from mobile and portable equipment within the proposed mining area and adjacent road system.	Noise sources would be intermittent and mainly occur during daylight hours.	Noise sources would be intermittent and mainly occur during daylight hours.	—	Very slightly higher noise due to use of slightly more equipment.	—	—	—
Increased air emissions from: • Diesel powered mobile and portable mining equipment and haul trucks. • Fugitive dust (PM_{10}) from earth moving activities, win erosion of haul trucks operation on paved and unpaved roads.	No air quality standard exceedences are anticipated from project emissions.	No air quality standard exceedences are anticipated from project emissions.	—	—	—	—	—
Hazardous Materials							
Accidental spillage resulting from: • Spills during onsite equipment fueling. • Mining equipment accidents/collisions	Low potential for impacts. Spill prevention plans, BMPs, and established clean-up protocol reduce probability of spill and of potential impacts.	Low potential for impacts. Spill prevention plans, BMPs, and established clean-up protocol reduce probability of spill and of potential impacts.	—	—	—	—	—